Canada's Natural Resources

And Their Use

Maurice Mandale

with teachers' notes by
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Series Editor: John N. Grant

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Foreword

A.B. Hodgetts in *What Culture? What Heritage?: A Study of Civic Education in Canada*, (Toronto: OISE, 1968), (the Report of the National History Project) presented a "strong indictment" of the way Canadian studies were being taught in the public schools.[1] It stressed the message that "Canadian studies in our elementary and secondary schools have stagnated while many other subjects seem to have surged forward".[2] The concern generated by this report led directly to the establishment of the Canada Studies Foundation (CSF) incorporated in 1970 as an independent, non-profit organization mandated "to find ways of improving the quality of Canadian studies in the elementary and secondary schools of all provinces".[3] From its inception the CSF has insisted that Canadians need a greater degree of understanding of our society, and that knowledge is a necessary prerequisite for understanding. Since 1970, the Foundation has been involved in experimental teacher-centred curriculum development of a pan-Canadian nature.

> No other organization has involved so many teachers in cooperative curriculum development endeavours from such a wide-spread geographical area. To be more specific: In its first phase (1970-75), the Foundation completed curriculum projects involving more than 700 people from every level of education and over 8,500 students from all provinces; in its second phase (1975-78), the CSF completed ten additional projects involving 400 educators in all provinces, the Yukon and the Northwest Territories. By February 1981, 51 volumes of learning materials developed as a result of these Foundation-sponsored projects had been commercially published and more than 30 volumes of learning materials were available from non-commercial sources.
>
> As well as being involved in curriculum development activities, the Canada Studies Foundation has developed a bilingual information service used by more than 6,000 persons. It has maintained a fully bicultural operation, providing services to francophone teachers and education officials in ten provinces. It has organized or provided resource personnel for local, provincial and national workshops involving more than 5,500

> persons ... Throughout these activities, the Foundation has been consistent in its objective of encouraging mutual understanding and respect among the diverse elements of Canada.[4]

After ten years of experience the Foundation produced a comprehensive rationale for Canada Studies programs. This rationale, authored by Paul Gallagher and A.B. Hodgetts and entitled *Teaching Canada for the '80s* (O.I.S.E. 1978) concluded that while "significant improvements in studies of Canada have taken place over the past ten years"[5] the development of Canadian studies had reached a plateau. It stresses that:

> The need now is for something more than merely continuing expanding what is already being done. The need now is for a cooperative and systematic nation-wide effort to improve the quality of studies of Canada in Canadian schools. The development of ... a common framework of studies consistently "pan"-Canadian in objective and designed in truly "pan"-Canadian fashion, touching all curriculum areas and spanning the full range of school years in a coordinated manner, is now the pressing need.[6]

Elsewhere the authors explain that:

> In our work with the CSF, we have found that the normal social process by which our young people develop their values, attitudes, and standards of judgment through strong regional and ethnic forces is not yet balanced in formal education by sufficient opportunities to study, to know about, and to understand Canada as a whole. We believe that *Canada* studies – as distinct from all other more restricted *Canadian* studies – should deal with our society as a totality, in country-wide, interlocking perspectives that can be shared by all Canadians wherever they may live. Otherwise, as the National History Project and many others have emphasized, this area of education will continue to be another divisive force in our society. The Canadian studies movement, in all its variety of techniques and products, should be sustained and nourished. What is needed now, however, is a common framework of ideas that educators in all provinces should use in the development of Canada Studies that will be country-wide in perspectives and objectives. The traditional Canadian practice of different groups and jurisdictions concurrently and independently searching for answers to specific provincial or regional concerns needs to be supplemented by an interprovincial cooperative attack on problems shared by all groups and jurisdictions. The luxury of each going

> off in his own direction can no longer be afforded, financially or educationally, in Canada.
>
> This book is exclusively addressed to the question, "What should young Canadians *understand* about their own country?"[7]

Teaching Canada for the '80s is the position statement of the Canada Studies Foundation and all development activities of the Foundation are related to the broad curriculum outline it contains. *Teaching Canada for the '80s* breaks Canada Studies into four separate but interrelated components. These four broad themes are: (1) the Canadian Environment; (2) the Canadian Political System; (3) the Canadian Economic System; and (4) Canadian Public Issues. In order to create material designed to fulfill the objectives of the CSF and to reflect its pan-Canadian thrust a number of regional centres were established, each charged with the responsibility of responding to one of the components. The Atlantic Institute of Education accepted the task of co-ordinating the development of materials that would deal with the theme "the Canadian Environment".

The term "environment" is used in *Teaching Canada for the '80s* "to describe the totality of the basic features of Canada, the interactions between them and their far-reaching effects".[8] This is a much broader usage than any meaning it might have in biology or ecology and includes the entire Canadian milieu, "the composite of the physical, social and cultural characteristics of Canada, viewed as a single entity".[9]

The "basic features of Canada" which create its environment are those characteristics which collectively make Canada a unique country. It should be recognized that individually these basic features are not unique to Canada but are shared by many political communities. At the same time, it must be realized

> ... that no other political community has the same composite of basic features and the same relationships among them. And that is what makes Canada a unique political community just as all other political communities have a unique composite of basic features and particular relationships among them.[10]

The most important basic features that relate to Canada include:

(1) Canada is a northern, vast, and regionally divided country.
(2) Canada has a broad natural resource base composed of both renewable and non-renewable resources.
(3) Canada is an industrial, technological, and urbanized society.
(4) Canada is a culturally diverse, multi-ethnic country with two historically predominant linguistic and cultural groups.

(5) Canada is exposed to a multitude of external economic, political, and cultural influences.[11]

While the authors point out that these characteristics are not meant to be subject to a deterministic interpretation they do suggest that these characteristics provide "strong constraints within which policy formation, leadership, and authority must be exercised and public opinion formed in Canada".[12]

The set of materials published under the series title *Aspects of the Canadian Environment* deals directly with the five basic features which characterize the Canadian environment. Each basic feature has been developed to provide teachers and interested readers with sufficient background information to create a working base of knowledge upon which to build their understanding of the country. It should lead to an understanding

> ... that the basic features are the major sources of diversity in Canada; that they are strong factors in the formation of public opinion and the differences in viewpoint on public issues in various parts of the country; that they generate most of the problems of continuing concern to Canadians and cause social tension; and that they substantially influence the structure and functioning of Canada's political and economic systems. All other Canada Studies should be approached with the background knowledge provided by a careful analysis of the basic features of this country.[13]

There are thus five sections to this series, each of which includes a major paper as well as a set of "notes for teachers" dealing with the pedagogical aspects of the material. The five sections are:

(1) "Canada: A Land of Physical Diversity" by Doreen M. Tomkins, and (1a) Teachers' Notes by the author;
(2) "Canada's Natural Resources and their Use" by Maurice Mandale, and (2a) Teachers' Notes by Marcia Armstrong;
(3) "Canadians and their Economy: Today, Yesterday, and Tomorrow" by Barry Lesser and Bruce Roald, and (3a) Teachers' Notes by the authors;
(4) "Canada's Peoples" by Anthony Burton, and (4a) Teachers' Notes by Gordon Watson; and
(5) "Canada and the Wider World" by Colin Howell and (5a) Teachers' Notes by Glenda Redden.

These follow closely the five basic features given above and provide pertinent background information and a bibliography for further reading. The notes for teachers offer ideas for classroom presentation of the material and also contain suggestions on other sources of information. Care has been taken that each is as up to date as possible.

A careful reading of the material will demonstrate its usefullness to teachers. It will also be equally obvious that there are a number of ways that it can be used. Some readers might be interested in only one or two of the aspects of these studies. These will find that each is a separate unit (insofar as that is possible) and can be read (although perhaps incompletely understood) without dealing with the other areas. These readers will find that the "Teachers' Notes" tend to deal with each topic individually. It must be stressed, however, that, even if each unit is taught separately, or if only one of the five is used at all, one should

> ... emphasize the interrelationships of these features. Out of such a study should come a synthesis: a view of the nature of Canadian society seen as a whole, the consequence of a composite of the basic features of the Canadian environment and their interaction. The broad objective throughout the study should be to help students develop an overview of the character of Canadian society, the forces that have shaped it, and the institutions that have sustained it.[14]

Readers will discern that there are two important elements within the discussion of the Canadian environment. The first includes the basic features and a consideration of how these are interrelated, while the second emphasizes the consequences of the above on Canadian society. The consideration of interaction of geography, history, economics, resources, and people should reveal much about what makes Canada unique and distinctive.

Relationships among the basic features can be developed as each individual unit is covered. That Canada is both physically enormous and diversified is obvious after studying Doreen Tomkins' section. A similar reading of Anthony Burton's study of the people of Canada reveals that the people who occupy the land are equally diverse in their origins and cultural backgrounds. The reaction of these peoples to the land and their use of the natural resources, as described by Maurice Mandale, has a direct relationship to the economic development of Canada as discussed by Lesser and Roald. But, as is emphasized in the economic considerations, few countries are allowed to develop uninfluenced by their neighbours. Therefore, Howell's work examining Canada's place in the world helps to further explain the fact of Canada. While history may not have a great effect on the physical environment it has had enormous influence on what physical environment is to be included in any political community and by whom and how the physical environment is to be used. There can be no question of the impact all of these features have had on the cultural environment. While it is unnecessary to further elaborate these initial relationships it is necessary that they be explained. It would further be useful to students understanding to analyze current issues which illustrate a whole variety of relationships. One such issue might be the building of a pipeline from the far north, as presented in *Teaching Canada for the '80s.*[15] Another might be transcontinental rail transportation or the development of our offshore oil reserves. Such issues should be examined in such a way so that students will not only have the opportunity to understand the debate itself but to develop relationship building skills as well.

Consider the possibilities for learning contained in the examination of the issue of the movement of electrical power from Labrador through the Province of Quebec to national and international markets. This is a controversy that can, and for understanding should, be examined under the heading of the "five basic features". Any discussion of this issue would immediately assert the fact of the northerness of the source of power on the Churchill River. This would draw attention to the fact that much of Canada's natural resource storehouse is considerably north of most of our major population centres. This raises the question of protection of the delicate ecology of the North, the safeguarding of the position of northern people and the demands of the rest of the country. The energy supply of Labrador is electrical power and while the river runs it will be produced. This, however, centres attention on the issue of the use of renewable and non-renewable resources, and also on the fact that Canadians, again partly due to our size and our northern location, are the largest users of energy in the world.

The difficulty of transporting the electrical power of the Churchill is not only due to climate, distance, topography, and ecological considerations, but also provides an example of regional and provincial division within Canada. The Province of Newfoundland and Labrador has long demanded that they be allowed to move the power across the Province of Quebec without dealing with the Hydro Quebec middleman. This has not yet been possible. Newfoundland insists that if interprovincial pipelines can be constructed so can an interprovincial hydroline. The Government of Canada has been caught in the middle. In the balance lies national needs, provincial rights, federal-provincial relations, financial considerations and perhaps the historic claim of Labrador by Quebec. This study would also consider the need for energy far from its source revealing Canada as a highly developed, technological, industrial and urbanized state. It would also reveal that much of the Labrador power is destined to markets in the United States. This fact opens the subject to the examination of our peculiar relationship to our only continental neighbour. This examination would expose the fragility of our cultural and national existence and the inherent dangers of "sleeping with an elephant".

Any classroom teacher would be able to develop these, and other, relationships in any number of similar topics. What is stressed here is that such relationships must be drawn and that students must be given the opportunity to acquire the prerequisite background information and the necessary skills to assist their own understanding of this country as well as introduce students to some of the complexities of making major decisions in Canada.

This example and those contained in *Teaching Canada for the '80s* demonstrates the process by which a more complete understanding of an issue can be developed. Again, the various parts of this series will greatly assist in bringing about this understanding as they supply the prerequisite background information.

If studying the basic features and the interrelationship among them helps answer the question"Why?" then examination of the consequences these hold for Canadian society should address the question "So What?". Just as the examination of causes allowed students the opportunities to analyze an issue – to break it down into its component parts and study each separately – the consideration of consequences will give them the opportunity to synthesize the findings – to rebuild the evidence in response to a particular problem. This skill may lead them to discover that while all Canadians have many of the same basic desires they also have many, and sometimes conflicting, loyalties. Regionalism, spawned by geography and reinforced by history, economic disparity due to an uneven distribution of natural resources and a variety of economic opportunities, and a richly diverse population often associated with one region, or one part of a region, have all helped to create loyalties that have threatened the unity of Canada itself. The challenge for Canada is to balance diversity and unity. Hopefully, some students will

> ... begin to recognize that, if Canada is to respond to the legitimate and diverse aspirations of all its members, some level of consensus among Canadians is necessary to balance the normal frictions among groups in Canada.[16]

There is no one single "correct" story of Canada, just as there is no one "correct" Canadian. The interpretation of the development of one region cannot represent the story of the development of the nation. Each region and sub-region and each of Canada's peoples has their own story. Unity can, however, be found in the basic features, their interrelationships and their consequences. Their study will help inform students of what Canada is and why it developed as it did. This background will provide students with the setting for more sophisticated studies of Canada and perhaps help respond to the charge that Canadian schools are not sufficiently Canadian.

As co-ordinating editor of this series of new works expressly developed for it, I would like to express my gratitude to the authors who worked so diligently to marry their academic interests and expertise with the curriculum demands of *Teaching Canada for the '80s* and the perceived needs of junior-high school teachers. Thanks too are extended to the many reviewers, too often forgotten, who examined these works and subjected them to a most rigorous scrutiny and in no small way will be responsible for any success they may enjoy. The encouragement, support, and leadership the project received from the Atlantic Institute of Education and the Canada Studies Foundation in the persons of Dr. William Hamilton, Dr. Andrew Hughes and Dr. Robert Anderson has been much appreciated. Special thanks are also extended to Beverly Quillan, Joanne Eisener and John Knight of the Atlantic Institute of Education.

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FOOTNOTES

1. A.B. Hodgetts, *What Culture? What Heritage?: A Study of Civic Education in Canada*. (Toronto, OISE, 1968), p.5.
2. *Ibid*., p. 7.
3. The Canada Studies Foundation, *The Work of the Canada Studies Foundation*, (Unpublished Document, 1981), p.1.
4. *Ibid*., pp. 1-2.
5. A.B. Hodgetts and Paul Gallagher, *Teaching Canada for the '80s*, (Toronto: OISE, 1978), p. v.
6. *Ibid*., p. vi.
7. *Ibid*., p. 2.
8. *Ibid*., p. 13.
9. *Ibid*., p. 37.
10. *Ibid*., p. 10.
11. *Ibid*., p. 12.
12. *Ibid*., p. 13.
13. *Ibid*., p. 12.
14. *Ibid*., p. 37.
15. *Ibid*., p. 47-48.
16. *Ibid*., p. 50.

Introduction

Canada was first explored and settled by Europeans in pursuit of its natural resources. At that time only a narrow range of resources had been identified, but even this narrow base was sufficient to tempt entrepreneurs, traders and settlers to risk the dangerous crossing of the Atlantic Ocean. As time unfolded the true extent of the resource base far exceeded early estimates. As science and technology developed more resources were drawn into the orbit of economic viability and as economic circumstances changed previously uneconomic reserves became profitable. This process still goes on today in a world which changes very rapidly.

This book will attempt to assess the variety and extent of the Canadian resource base. Emphasis will be on the consequences of resource development and the use of these resources. Where figures are used they will emphasize the contribution that the exploitation of resources makes to the Canadian economy in the 1980s. However, the emphasis in this account will be more on themes. What are the environmental consequences of coal extraction in northern British Columbia? Why is there renewed interest in the long-abandoned Nova Scotia gold seams? What are the special difficulties of managing fishery resources? Why has there been so little concern for management of forestry resources? What role does resource development play in opening up Arctic areas? What weight do we give to the preservation of native societies in resource development? There are many questions like these.

An initial section considers the nature of a resource and how this changes over time and under what influences. The bulk of the chapter considers the major resource groups; climate, water, agriculture and fisheries, energy, minerals, forestry, and wildlife. A final section considers a number of themes such as the role of resources in economic growth, the resource town, and resources as part of nature.

The development and use of natural resources affects all ages and generations. Young people today depend to a large extent on how their parents' generation manages a resource endowment for the continued progress and prosperity of society. Exhaustible resources cannot be replaced and non-exhaustible resources may be used up faster than they are replenished. The inter-generational aspect of resource development is frequently invoked as a noble aim, but just as frequently is ignored or forgotten when corporations and governments come to develop the resource. An education process which emphasizes conservation principles in resource use and the linkages between many disciplines in resource use is an important step in developing an awareness of the importance of Canadian resources to the future of the country.

Maurice Mandale

Resources

1

The Concept of a Resource

Dictionary definitions of the word "resource" draw on a number of themes, including:

- a stock or reserve upon which one may draw when necessary;
- something that lies ready for use,
- the collective means possessed by any country for its own support or defence;
- those forces of wealth supplied by nature.

The two themes that stand out are (1) stocks (or stores) and (2) means. Resources have little value if they remain undeveloped, and they are only a means to other ends. A series of examples can illustrate this:

(a) An iron ore body is just so much rock and mineral if it remains in the ground. Its real value comes when it is refined to make steel which is turned into anything from paper clips to super-tankers;

(b) The process of turning iron ore to steel to final, usable products is largely accomplished by using available technology or machinery operated by people. To invent, manufacture and run this machinery requires a store of knowledge learned in homes, schools, and by experience. Such knowledge is reworked and combined in different ways to arrive at skills necessary to achieve these ends;

(c) Production of goods and services takes money. A bundle of banknotes hidden in a mattress is a resource. This same money lent to an inventor or manufacturer to develop ideas and products is a much more useful way of employing this resource.

Economists lump these three examples under the headings of land, labour and capital respectively, or more generally as natural resources, human resources and capital resources. These have for many years been regarded as the three major factors of production. A resource goes into the production process to produce something else with a higher economic value to society. Resources are, therefore, assets used to increase human wealth and well-being.

Natural resources have for a long time been regarded as "free gifts of nature" and include air, land, water, minerals and so on. They are, however, seldom "free" as they are part of a larger, environmental system more or less in equilibrium. We disturb that equilibrium every time we take out more than is put back. If we take more water out of a lake than is returned to the lake as rain or snowfall, water levels will fall, water temperatures may rise and thus will support fewer fish. This is one of the "prices" we pay for the use of a resource like the lake's water. It is useful, therefore, to think of natural resources as being the result of natural processes and being available for use by people, but usually at a cost.

Human resources encompass people and their abilities, whether learned, acquired or inherited. Education's role is to train people to use abilities and skills to further themselves as members of society. The range of skills is immense, from the unskilled labourer to people such as Albert Einstein or Frederick Banting. People produce the ideas which provide the impetus for the use of natural resources.

Capital resources, such as tools or machinery, are man-made aids to production. The advance of industrialization has largely been one of inventing the means to put man's ideas into practical application using the natural resources available. This has involved the mobilization of captial resources in increasingly large amounts to provide the means of production.

Major Natural Resource Groups

Major groups of natural resources are relatively few in number. The Greek philosopher Aristotle identified the four elements in nature as earth, air, fire and water. Natural science has since shown that things are much more complex than this but Aristotle's groupings can still provide a useful summary. *Earth* would include land, soils and minerals, *air* would include the gases which are indispensable to many natural processes, including life, and together with *water* would make up major sustaining elements for all life, while *fire* would represent the energy required by all productive processes.

Resources are also grouped according to whether they are renewable or non-renewable. Renewable resources are usually restored subject to natural laws and processes; they include water, agriculture, fishing, forestry and wildlife resources, as well as some kinds of energy resources like solar power, hydro power and tidal power. Non-renewable resources are exhausted in the process of being used; they include most conventional kinds of energy resources like coal and oil and mineral resources. Understanding and managing relative rates of renewal or depletion are at the centre of our modern industrial society. This should include not only management for human progress but also for all other living organisms that are much less capable of modifying their own environments to assure survival of the species. The role of man as environmental manipulator is at the centre of this account of natural resources.

The Dynamics of Resource Development

In the past the increasing scarcity of a resource has resulted in one or more of several developments. The society which was built up around a dwindling resource base has been forced to migrate to other areas where there were more supplies of resources; or the society has sent out explorers to search for more supplies of the resource in other parts of the world and to obtain these supplies either by imposing soverenty or by engaging in trade; or scientific and technological innovations have made it possible either to switch dependence to another, more abundant resource or have extended the "life" of the depleting resource by making recovery and use of remaining stocks more economical.

In this respect, therefore, much of human history comes down to the response by societies to the increasing scarcity of a given bundle of resources, the advances of technology to turn those resources more efficiently into useful products, and the speed and success with which these processes take place.

Fundamental to these processes is the interaction between economics and politics. These two closely inter-related forces affect resources as they affect most other things in a society's life. Economic forces dictate the prices paid for most things, including resources. The success of political forces is largely determined by economic progress and can, in turn, dictate how prices of commodities move with regard to each other in the market place. In the twentieth century economics and politics have become enmeshed in a global all-pervasive system. The price of oil provides an example of the influence of this system.

The actions of the Organization of Petroleum Exporting Countries (OPEC) since 1973 have affected the lives of all Canadians by setting the price paid for crude oil at a much higher level than had prevailed up to that time. Although this price bears little relationship to the actual costs of production OPEC members could increase prices more or less at will because they control a large part of production and reserves. Initially this was essentially a political lever but more recently the realization has dawned that many of these countries are exploiting the only real resource they possess to build up their respective societies. At the same time the high prices paid for imported oil in Canada have made it more worthwhile to explore such options as tar-sands developments, tidal power or Arctic or offshore energy resources as well as stimulating a return to coal as a source of energy.

This is one very typical example of how the nature of a resource has changed in response to economic and political forces. Other examples have taken place over longer time periods. The great age of exploration and the dissemination of European influence and her people occurred in response to increasing demands on a declining resource base in Europe. English and Portuguese fishermen crossed to the Grand Banks of Newfoundland to fish for cod to feed a rapidly increasing population at home. This eventually led to the opening up of the whole continent and its settlement and development.

This settlement involved problems. The forests which provided native Canadians with game for food and most other necessities of life were cleared for agriculture. In the west the Plains Indians, whose annual movements over large areas were largely dictated by the migration of herds of bison, were displaced by European cattlemen and farmers. Imperfect understanding of Prairie soils and climate led to over-cultivation and disaster in the Dust Bowl of the 1930s, for which we are still paying the costs. In the 1940s oil and gas were discovered beneath Prairie soils in Alberta and yet another resource entered the story. Thus, during a relatively short time span of about 100 years the predominant society of the High Plains in Alberta changed from one which was essentially nomadic, first to a society based on cultivation and cattle and then to an urban-centred society based on exploitation of energy reserves. All three have been associated with distinctive lifestyles and landscapes.

Development of modern industrial societies has not been the same everywhere. The Industrial Revolution in Europe resulted in a series of societies dependent largely on their manufacturing capabilities. As domestic resources have declined they have been largely replaced by supplies obtained by trade. Europe also began exporting another abundant resource, its people. During the nineteenth century the natural resources of North America attracted a great wave of settlement. Two important sovereign nations emerged from this process. The United States severed its colonial ties at an early stage in its development and went on to become a dominant force in the events of the twentieth century. Its natural wealth attracted more settlement and an increasing market within its own border encouraged the development of a major manufacturing sector. Only in recent years have the limits of American resources been approached, mostly in terms of energy and water, and the search by this giant nation to replenish or replace its supplies of these resources will affect global patterns of trade and politics.

Canada was settled along parallel lines and from a similar background. It, however, severed its colonial ties by evolution rather than revolution and today is an important member of the British Commonwealth. Its population is only one-tenth that of the United States, probably because its more northerly position gives it an extreme climate with cold winters. In spite of the closeness of its ties with

Britain and Europe it is dominated economically by its powerful neighbour to the south.

The Canadian economy remains essentially based on exports of raw or unfinished resources. There are exceptions, however, such as the steel mills and automobile factories of southern Ontario. Development of these industries has increased the value of Canadian resources by capturing some of the increased "economic rent" which results from processing raw materials. The value added to the primary resource stays in Canada in the form of extra wages and higher prices for a more useful product. In the opinion of many, however, too little secondary processing and manufacturing occurs in Canada and it is a fact that much of that which does occur is carried out by non-Canadian concerns. This means that much of the extra income generated leaves Canada for the pockets of share-holders in other countries. This foreign control of Canadian resources will be a recurring theme in this account.

A final example of the response by a society to resource scarcity touches on nations such as Japan, which is very poorly endowed with natural resources. In spite of this there has been an astonishingly successful and rapid growth of the industrial sector based on a plentiful supply of skilled labour allied to a sense of self-discipline and hard work many westerners alternatively admire and resent. Japan also is a major market for Canadian resources.

Resources as Part of Nature

The larger ecological effects of resource development impose a set of "costs" which rarely enter the balance sheets of corporations or governments. The case of "ecology versus economics" is largely a phenomenon of the 1960s and 1970s. It could be argued that only in the 1960s did western society reach a sufficiently advanced quality of life that it could afford to think about such "luxuries". Increased individual mobility, disposable income and leisure time meant that North Americans in particular began to appreciate the non-economic aspects of their land, air and water resources. The first generation for which higher education was taken more as a right than a privilege emerged from universities and colleges to look at their environment from new perspectives. The effects of clear-cutting forests, dumping mine tailings into lakes and rivers, building highways in arctic environments, taking too many fish from the seas, burning too much oil or coal, or indiscriminately spraying chemicals on woods and fields all began to be regarded as costs to society, if not to the individuals or organizations directly involved. "There's no such thing as a free lunch" became a catch-phrase as regulations were written into law books to manage such abuses of society's natural assets.

Usually the rate of exploitation of a resource has been equated to the period of time it takes to pay back the capital which was employed to make the resource accessible. Throughout the industrial era this has been dictated by economic and financial criteria. Because trees, for example, seem to be plentiful in Canada and, what is more, given time regenerate without interference by man, they were largely excluded from a pay-back analysis which involved replanting because the growth time was much too long in Canada's climate to afford a realistic rate of return to capital. No consideration was given to changes of habitat which resulted from cutting trees down or to increased runoff which stripped many forest areas of their soil and increased sedimentation in lakes and rivers.

We have only begun to include these external costs (so-called because they are considered to be outside the economic production and consumption process) as part of our overall societal budget. The rapid rise of ecology as a major discipline has played a large part in the process of understanding changes in the ways that man interacts with his environment. This account of Canada's natural resources will repeatedly come back to this aspect as well as to the social consequences of resource depletion and use.

Major Areas of Canada and Their Resources

Canada as a nation encompasses the second largest land area in the world (after the Soviet Union) yet is home to only 24 million people, most of whom are pressed up against the southern border with the United States. By comparison, the People's Republic of China which is not much smaller than Canada (9.6 million km^2 as against 9.97 km^2) supports a population of more than one billion people (more than 40 times as many) and many countries with a much smaller land area (Great Britain, West Germany, Japan) support more than twice as many people as Canada. Reasons for these discrepancies are complex and in part are rooted in political, economic, and historical differences. To a significant extent, however, Canada's physical size and northerly location can help explain some of these differences.

There are six major geographical regions in Canada and fairly narrow groups of resources can be associated with each region. These regions (the Atlantic Region, the Shield, the St. Lawrence Lowlands, the Borderlands, the North and the Western Cordillera) and their respective resource endowments reflect the diversity which characterizes the whole country. This diversity is the envy of most other nations in the world, especially because it is allied to a fundamental political stability. There are, however, problems including non-Canadian ownership and a smouldering resentment over who within Canada benefits from development of resources. The sheer physical distances involved mean Canadian society is very thinly spread over a large area. Ultimately the concept of Canada as an economic entity may be quite different from the concept of Canada as a culturally homogeneous unit. Distances between places and the emptiness of large areas pose challenges and are themes which will recur in the following pages.

Climate and Resources

2

Climate is Dynamic

The motel owner in Prince Edward Island and the winter resort operator in the Rocky Mountains are among the few people who would regard climate directly as a resource. Weather, however, is part of the daily life of all Canadians. It affects the demand for energy (to heat or cool homes and workplaces), it affects the growth of crops, and it affects the water supply. All of this relates to Canada's position as a northern country influenced during a large part of the year by Arctic weather systems. Only during the last few decades has supply of necessities to northern communities from the south replaced traditional lifestyles.

In the more developed south summers may be short but generate enough heat and light to sustain agriculture. Scientists have developed strains of crops which will grow and ripen rapidly during the relatively short growing season.

Man's adaptation to climatic conditions is not total and changes in climate can be profound. The earth's weather systems are the result of trying to achieve a "heat balance" between the equator (which receives more sunlight and heat) and the poles. The amount of radiation from the sun, however, has fluctuated and climatic patterns have changed as a result. The evidence of these changes is widespread. Coal and oil deposits in Arctic Canada are the remnants of highly productive tropical forests which flourished many millions of years ago. More recently all of Canada and large areas of surrounding seas were covered by ice up to 3 km thick. The Ice Age began about 1 million years ago and there has been a series of advances and retreats of the ice sheets. The last advance peaked about 20,000 years ago when average annual temperatures were about 5° C colder than at present. Many scientists believe the retreat we are in presently has also peaked and the next advance is well under way.

In fact, fluctuations of as little as 1° C in annual average temperatures have serious effects. The margins of cultivation are changed and in a major food-producing nation like Canada this would involve major modifications. As the dynamics of climate are global in scale the worldwide demand for food will also change.

The ability of man to adapt to climate gives him a flexibility all other creatures lack but this flexibility has costs such as providing energy for human comfort and food production. Eventually, man himself is limited by natural restraints which are themselves influenced by climate.

Climate and Economic Activity

More urgently, man's ability to cope with a wide variety of weather conditions has largely been confined to the construction of weatherproof homes and work-places and in Canada this has meant climate has become an important factor in planning and management. Periodically, however, there are disasters associated with climate which involve loss of life and great financial costs. The Groundhog Day Storm in 1976 will long be remembered in the Maritimes; the summer of 1980 will be associated with major forest fires in northern Ontario and the

Figure 2-1

Selected weather events, and some losses directly caused by them 1868-1973

Year	Event	Estimated losses	
		Life	$'000,000
1868	Drought at the Red River Settlement		
1860s	Storms on the Great Lakes		
1885-96	Drought on the Prairies		
1912	Tornado at Regina, Sask.	30	4
1917-21	Drought on the Prairies		
1930-36	Drought on the Prairies		
1935	Snow-stórm at Vancouver, BC		
1944	Tornado at Kamsack, Sask.	(2,000 homeless)	2
1945	Low temperatures in Nova Scotia		4
1949	Drought in Ontario		100
1950	Red River flood		100
1953	Tornado at Sarnia, Ont.		5
1954	Hurricane Hazel, Ontario	100	252
1954	Wheat rust on the Prairies		33
1955	Drought in Ontario		85
1957	Hail storm in Saskatchewan		17
1959	Wet weather in Saskatchewan (harvest lost)		12.5
1959	Snow-storm in Ontario		
1967	Snow-storm in Alberta		10
1969	Glaze storm near Quebec City, Que.		30
1967-68	Forest fires – all of Canada		100
1973	Drought in British Columbia		
1973	Glaze storm at Sept-Iles, Que.		10

Source: G. A. MacKay, "Climatic Resources and economic activity in Canada", in G. R. McBoyle and E. Sommerville (eds) *Canada's natural evnironment: Essays in applied geography* (Toronto: Methuen, 1976), p. 33. Quoted in *Canada Handbook 1978* (Ottawa: Supply and Services Canada, 1979), p. 22. Reproduced by permission of Methuen Publications, Toronto, Ontario.

winter of 1980-81 brought unseasonal floods to southern British Columbia. Increasingly, sophisticated financial institutions can only partly compensate for the monetary losses due to these natural disasters.

An influential school of thought ties climate and weather to the success of societies which have originated in temperate climates. The ability to take catastrophic events in stride breeds a phlegmatic character essential to experimentation, innovation and progress. The storms which are part of the seasons in northerly latitudes assist this process by stimulating the search for means of shelter and a continued flow of sustenance in spite of setbacks. In this respect industrial man is very much a product of his climate and history is full of examples of societies which have either failed to adapt to a realtively sudden climatic change or have not had the means or will to change rapidly.

Industrial man has, as never before, the capability to modify climate by his activities. On a global scale the accumulation of pollution in the atmosphere may result in a "greenhouse" effect whereby the sun's light and heat can penetrate to earth but the radiated (or reflected) heat from the earth is trapped. This may result in the climate warming which will in turn result in accelerated melting of ice from the polar ice-caps and increased sea levels. The burning of hydrocarbons in quantity results in large amounts of pollutants such as oxides of sulphur entering the atmosphere and eventually combining with water to fall as acid precipitation with adverse effects on freshwater systems and animal life. These are only two isolated concerns related to climate which have enormous economic and ecological consequences.

We must therefore consider climate in resource development. It controls ecosystem development and is unforgiving except over the longer run. It is possible that man can ignore climate in the shorter run but ultimately the position of the human species as part of a larger natural system will be influenced. In subsequent sections, particularly those on water, agriculture, fishing and wildlife, the influence of climate may not be articulated but its influence is paramount.

3

Water

Water, the basic resource, is fundamental to all life. In its various forms (solid, liquid, vapour) it is constantly circulating. Variations in time and from place to place, however, give water special properties, particularly as a resource. It can be used to produce energy; as an input to industrial processes or to cool manufacturing plants; in homes to drink or wash; as a medium of transportation; to irrigate farmlands; to produce protein in the form of fish and other aquatic organisms or as a dump for men's unwanted wastes. The importance of water is such that the adequacy of its quantity and quality will recur in many other parts of this account on natural resources.

Modes of Occurrence and Quantities

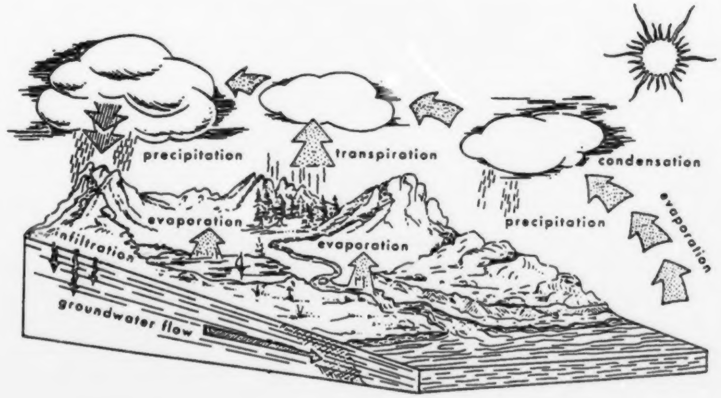
The way water alternates from vapour to liquids or solids is sumarized in the hydrologic cycle which takes place largely regardless of human claims on the water supply. Management of reserves and care for quality can help ensure that periods when use exceeds replenishment need not be times of drought. The close linkage between the hydrologic cycle and climate will be evident; precipitation is the method by which terrestial reserves are replenished and temperature affects the amount of rainfall which is available for use by speeding or slowing evaporation, or by promoting freezing or thawing.

Estimates indicate that about 8,000 billion tons of water fall on Canada each year as rain or snow, about 60 percent of which runs off directly in rivers. Between 30 and 40 percent of this runoff is locked up as snow or ice. A large proportion runs off towards the north away from major population centres. Precipitation, moreover, is uneven across the country; on the west coast it can exceed 3,000 mm in an average year while on the Prairies it is as low as 350 mm and in northern areas it can be much less than 100 mm. In British Columbia and the Atlantic Provinces runoff in rivers and streams is more than 80 percent of total precipitation; in Ontario it is 45 percent; on the Prairies this proportion drops to 35 percent. The remainder is either lost to evaporation or becomes groundwater.

Water is most commonly found on the surface and in the ground. Lakes, rivers and streams have their sources in rainfall, snowmelt and from the groundwater reserves by way of springs. The contribution by rainfall is intermittent and seasonal. Snowmelt is an important source accounting for as much as 40 percent of flow in rivers such as the Fraser and Saskatchewan. Groundwater enters rivers steadily even at times of year when precipitation is minimal or falls as snow. There are distinct seasonal flows to all Canadian rivers. Peak flows are usually the result of snowmelt in spring or early summer, often linked to heavier than usual rainfall.

Figure 3-1

The Hydrologic Cycle



Source: W.V. Morris, *Water*, Inland Waters Branch, Energy, Mines and Resources Canada (Ottawa: Supply and Services Canada, 1969). Reproduced in *Canada's Special Resource Lands* Environment Canada, Lands Directorate, Map Folio 4 (Ottawa: Supply and Services Canada, 1979). p. 168

About 777,000 km^2 of Canada's total surface are covered by freshwater lakes which contain an estimated 18,800 km^3 of water, or about 15 percent of world lake water. Further estimates indicate that runoff ranges between 0.07 million m^3 per second and 0.1 million m^3 per second, or about 7.5 percent of world streamflow runoff. Rivers in Canada carry about 410,000 litres per person per day which indicates a plentiful supply of water; however, the distribution is such that over a large part of the southern Prairies this available supply is less than 500 litres per person per day. In comparison, average municipal use is 590 litres per person per day.

Around the world there are an estimated 4 million km^3 of water stored in minute spaces between rock particles in the ground. Canada probably possesses only a small portion of this reserve because many of the rocks underlying the country are unsuitable as "aquifer" rocks. There are large areas of permafrost and many deep bedrock aquifers are saline. Good quality resources in quantity occur in the lower Fraser Valley, southeastern Manitoba, the lower Great Lakes-St. Lawrence region, and in parts of the Maritimes.

Groundwater supplies about 10 percent of municipal water system needs in Canada but its importance in supplying rural homes and farms by individual wells is much greater. The rocks in which the water is stored and through which it percolates must be of the correct porosity or permeability. Normally the quality of groundwater is consistently high but once it is affected by pollution it may persist for a long time because of the slowness of flow rates through the ground. Groundwater often occurs in areas (such as on the Prairies) with fewer dependable surface supplies; it thus has added importance in these areas.

Major Uses of Water

In the earlier years of settlement in Canada the demands on water supplies were quite small. Conscious location decisions were required for grist mills, weaving mills and sawmills, all of which relied on water for power. Around the turn of the century the first concerted efforts were made to investigate the amount of reserves as the use of hydro-electric power spread. Major expansions in industries such as pulp and paper and aluminum smelting in the 1920s increased industrial demands for water but this expansion in demand slowed during the 1930s as economic activity in general slowed. After the Second World War, however, rapid expansion of urban areas put new demands on water supplies and very little regard was given to how supplies should be managed particularly with regard to waste disposal. The role of water as an economic endowment thus came into conflict with its role as a medium of life.

The post-war years have been characterized by "multi-purpose" use of water reserves which has increasingly involved consideration of the next use by the uses preceding it; an industry or community can no longer discharge untreated wastes into a stream without regard for the downstream communities which rely on the river for drinking water. Increasingly there are sophisticated treatment techniques available to avoid contamination and pollution.

The two major types of water use are by withdrawal and non-withdrawal. The former actually removes water from its natural course, the latter does not. Withdrawal use includes domestic, industrial and most agricultural purposes. Non-withdrawal use includes hydro-electric power, navigation, recreation, and fish and wildlife purposes.

In withdrawal uses all or part of the water taken out is usually returned to the source. The amount of water actually consumed (not returned) will have an effect on downstream supply although in the long run all the water will return to the overall cycle. Recirculation allows some of the water to be used more than once; in manufacturing uses in 1974 almost 5.6 billion gallons per day were withdrawn for various uses but this amount met a gross demand of more than 13 billion gallons per day by being recirculated an average of 2.3 times. Estimates of total consumption (not returned) in all uses are in the order of 10 percent.

There is variation from region to region in the importance of different uses. Domestic and manufacturing uses vary largely in relation to regional populations with Ontario and Quebec as the major areas of demand. Major municipal uses include residential, commercial and public uses such as street cleaning, public swimming pools, fountains, firefighting, and institutions such as schools and hospitals.

Residential uses are largely accounted for by toilets (45 percent), bathing and personal (28 percent) and laundry and dishes (23 percent). Drinking and cooking account for only 4 percent of total residential demand. There are morning and evening peaks in demand and a seasonal peak when lawn sprinklers are in use in summer. Lawn sprinkling has an effect on the design capacity and cost of municipal water systems far out of proportion to its productive use and provides an example of possible conservation of water.

There are also peaks in demand each day in schools due to the concentration of athletic activities in the latter parts of the afternoons and subsequent use of shower facilities. Industrial water uses account for withdrawal of more than 2½ times municipal and rural demand but with recirculation this ratio rises to almost 6 times. Major industrial enterprises have tended to locate close to adequate water supplies whether for the water as a natural resource in the productive process as a coolant or as a means of transportation of goods. The concentration of industry in the St. Lawrence Lowlands is an example of this. Water is used in many ways by many industries and is usually available for no more than the cost of building facilities to withdraw water from the source. For this reason water has for long been regarded as a "free good" and much abuse has occurred in terms of wasteful use and waste disposal.

A special industrial use is in the mineral industry where water is used for injecting into deep wells to maintain pressure to force crude oil to the surface. Major use is in Alberta and much of this is considered "consumed" as it remains deep in the earth.

The reliance of agriculture on water needs no emphasis. Much of the water used in crop production falls as rain but in areas such as the Prairies, southern Ontario and southern British Columbia this source must be augmented by irrigation to achieve better yields. Water use for stock watering and much of that used for irrigation is considered consumed as little is returned to the natural source but is taken up by plants and animals. Irrigation in particular is an important concern in water management as much of it occurs in the Prairies where annual precipitation is low. There are numerous examples, however, of where

Figure 3-2

Water Use in Canada — 1974
(millions of gallons per day - mgd)

In 1974, an estimated 24,016 mgd of fresh water, equivalent to some 1,070 gallons per day per person were used for Public Supply – municipal and rural; Industrial Use – manufacturing, the mineral industry and thermoelectric generation; and Agriculture. The water withdrawals required to cover these uses are shown below by region and principal use.

Recirculation allows some of the water to be used more than once. Recirculation in manufacturing alone has made it possible to extend the 5,677 mgd withdrawn to meet a gross demand of 13,052 mgd and, in terms of all water uses in Canada, the 16,641 mgd has been stretched to meet a gross demand of 24,016 mgd.

	Municipal and Rural	Manufacturing	Mining	Agriculture	Thermoelectric	Total
Atlantic	170	682	101	12	120	1,058
Quebec	713	1,133	52	76	14	1,988
Ontario	782	2,646	93	121	4,785	8,427
Prairies	270	273	308	1,100	1,446	3,397
British Columbia	250	943	69	290	173	1,725
Yukon & NWT	6	–	13	–	–	19
	2,191	5,677	636	1,599	6,538	16,641

Source: Fisheries and Environment Canada, *Canada Water Year Book 1976* (Ottawa: Supply and Services Canada, 1976), p. 65.

crop yields from irrigated land are much higher than those of dryland farms on similar quality soils. Equally the increased use of agricultural chemicals (fertilizers, herbicides and pesticides) is worrisome as many enter the hydrologic cycle through irrigation water.
irrigation water.

The actual amounts of water involved in the major non-withdrawal uses are very difficult to estimate. Some of these uses, such as freshwater fisheries and hydro-electric power, will be considered elsewhere. Recreational uses of water are important particularly in this age of increased leisure time. Much recreation is intensive in nature occurring at particular times of year in relatively small areas. Most of the demand comes from an urban population so this demand will be concentrated as close to towns and cities as possible. These activities vary from fishing to water-skiing and swimming. Many beach activities can be adversely affected by deteriorating water quality and in this respect maintenance of recreational demand for a water-body is an indication of its environmental health.

Responsibility for Water Resource Management

There is much confusion over who has responsibility for management of water quality and quantity. Rivers or lakes often cross political boundaries or, like the St. Lawrence River, they actually form the boundary and therefore responsibility for water quality is shared or is assumed to belong to someone else. The problem of pollution of the lower Great Lakes is well known and is due to the large industrial complexes which have sprung up in both Canada and the United States on either side of the lakes.

The international administration of water resources has special problems. American population growth and economic activity have outstripped domestic water supplies, particularly in the relatively arid western states. Schemes to assure water supplies to these areas (including the large cities in the southwestern desert) involve Canadian reserves. Experience has shown that the question of water as a national or continental resource is largely unresolved in spite of frequent statements of friendship and common goals.

There has been more success in solving the pollution problems of the lower Great Lakes, largely by restricting the amount of phosphorus in laundry detergents and by the increased treatment of municipal and industrial effluents. This international effort provides an example of what could be achieved nationally, particularly by constructing sewage treatment plants. About two-thirds of Canada's urban population have some form of central sewage treatment including Toronto, Ottawa and Hamilton (100 percent treated), and Calgary, Edmonton, Regina, Winnipeg and Fredericton (90 percent treated). At the other extreme Montreal treats less than 15 percent and the coastal cities of Victoria, St. John's and Halifax have minimal facilities.

Sewage in rural areas needs special care since there is much more reliance on water supplies from individual wells. This water needs protection from sewage contamination by building septic systems in suitable soils. In both rural and urban areas the intrusion of man-made chemicals into water supplies is particularly troublesome because of the characteristics of many of these chemicals and their persistence. Management of water resources has only just begun to address the worst of these and associated problems.

Prospects for Water Management

Canada has an abundance of freshwater supplies although the resource is unevenly distributed. On the Prairies, a major agricultural area, there is often a water deficit. Many agricultural enterprises depend on rainfall for necessary moisture to aid growing crops. The drought of summer 1980 demonstrates how risky this can be and there may be further developments in irrigation in the future to avoid drought and an already scarce resource may take on increasing value.

Another issue which surrounds water management is concerned with who actually undertakes responsibility for management, particularly where supplies are shared by more than one jurisdiction. This includes the split between municipal and provincial governments, federal and provincial jurisdictions, and between Canada and the United States. The management of water quality in particular falls into this category of issues. The start of the clean-up of Lakes Erie and Ontario demonstrates what can be done. The increasing concern over such pollutants as man-made chemicals, toxic metals, oil and sewage demonstrate what needs to be done in the future.

Agriculture and Fisheries

4

Protein Sources and Needs

Food is the means by which energy from the sun becomes human energy or muscle-power and brain-power. The need for food by the people who make up a society or community is basic to life itself. The supply of food will dictate how the society progresses and prospers. All of the industrial revolutions in history have been preceded by an agricultural revolution. The ability of a farmer to produce more food or fibre than he needs for the continued health of himself and his family has meant that manpower has been released from the production of food into other economic activities.

The maintenance of mental and physical health is essential to progress in society. The role of diet in health is now much better understood since the rise of food sciences and nutrition studies. In spite of this knowledge an estimated quarter of the world's people are underfed or malnourished and at the other extreme most industrial populations, with plentiful supplies of food at reasonable cost, cannot be called very healthy. Heart disease is the biggest single cause of death in North America and this can be attributed in part to diet, particularly overeating. The ramifications of this gross imbalance in world food availability patterns may be profound in terms of economic and political change.

The two major food-producing sectors are agriculture and the fishery. Canada has important industries in both sectors as well as many problems associated with the management of each.

Agricultural Land Resources

In spite of its size only a very small proportion of Canada is suitable for farming and even less is actually farmed. The harsh climate of much of the country means that growing seasons tend to be short, and even where agriculture is an important regional industry it relies on a short but very intense burst of heat to make crops grow. The development of strains of grains which can mature more rapidly, or which can be planted in the fall and survive the winter frost to grow in spring, has done much to take the risk out of many farming operations.

Approximately 68 million ha of land in ten provinces are cultivated, or about 7.5 percent of the total land area. The efforts of the Canada

Land Inventory have identified the agricultural capability of the land in most areas where climate allows cultivation. About 11 percent of the land area is capable of some agricultural production (105 million ha); only 46 million ha, however, are free from severe limitations to agriculture and only 4.2 million ha have no significant limitations. Most of the best land is in southern Ontario, Saskatchewan and Alberta. Other, lower quality, but still good land is quite widely spread among the ten provinces but tends to be in smaller blocks in river valleys or coastal lowlands.

Major limitations to production result from climate, undesirable soil structure, erosion, low fertility (including rainfall), salinity, stoniness, nearness of bedrock to the surface and topography. This list emphasizes the links between agriculture and physical processes.

Agricultural Growth in Canada

In spite of a scarcity of farmland relative to its size Canada's agricultural industry is on a world scale. Much of the settlement of Quebec and Ontario was based on reserves of land for farming as was the expansion westwards in later years. The development of agricultural land ran hand in hand with the extension of railways and roads to allow farmers to get their products to markets. The St. Lawrence Seaway was built partly to facilitate shipments of Prairie grains from terminals at Thunder Bay. The spread of settlement in the Prairie Provinces is almost exclusively an agricultural phenomenon.

Early settlement in eastern Canada was largely to exploit reserves of trees, minerals and fish. Agriculture in the Maritime Provinces developed unevenly and mainly to supply local markets or as a subsistence activity. The land resource in the Maritimes was also marginal in quality, particularly under the prevailing agricultural science and technology of the 18th and 19th centuries. There were periodic bursts of optimism and immigration based on agriculture but these were not sustained and much of the land which was cleared was later abandoned. Notable exceptions to the generally depressed state of agriculture in the Maritimes were apples in Nova Scotia's Annapolis Valley and potatoes in Prince Edward Island and the Saint John River Valley in New Brunswick.

Meanwhile, settlement spread up the St. Lawrence Lowlands and into Ontario. Agriculture was the reason for settlement on the fertile lands of southern Ontario and grains began to flow to the United States and elsewhere. During the last 30 years of the nineteenth century a great wave of landless settlers from Europe descended on the Prairies and the future twin centres of gravity of Canadian agriculture were firmly established in southern Ontario and the grain-growing areas of Manitoba, Saskatchewan and Alberta. In later years a livestock industry also became characteristic of Alberta and the fertile valley bottoms in southern British Columbia became important for the production of fruits and vegetables.

This, however, was not solely due to available supplies of good farmland. The world emerged from the Great War in 1919 with, among other things, the internal combustion engine applied to many more uses than before the war. Agriculture was to benefit from this in dramatic fashion. The adoption of the engine to machinery allowed a single person to accomplish much more than with a team of horses. The great increases in agricultural productivity which characterized the twentieth century had begun. The gasoline powered engine was later to be joined by greatly improved methods of farming, and new breeds of animals and plant hybrids. After the catastrophes of the 1930s there was also the greatly increased involvement of government in agriculture and in marketing its products.

The full force of increased productivity in agriculture was felt after 1945. Great numbers of rural people began to move to the towns as farming jobs declined and industrial opportunities increased. Only the more efficient farmers could survive and these greatly increased the capital investments on their farms in terms of machinery, buildings and land. Farms became bigger and farmers increasingly had to assume the role of business managers as well as herdsmen or reapers. Exports of agricultural commodities became an important component of Canada's trade.

Agriculture in most industrial societies presents a paradox; it represents one of the success stories of efficiency and productivity yet production is still shared by very many small operators none of whom individually can influence the market very much. Marketing boards, usually with some encouragement and participation by government, have become common for many commodities enabling farmers to maintain their standards of living from year to year among fluctuations in prices for agricultural products. These swings may result from good or bad harvests at home and overseas. In spite of the modern sophistication of many farm operators the farmer is still dependent on a certain combination of weather conditions at certain times of year. In Canada this regard for weather is particularly acute because many agricultural enterprises occur on the climatic margins of North America.

The figures testify to the present importance of the industry: a total capital value of more than $70 billion in 1978, or about $215,000 per farm, an increase from about $15,000 in 1951; farm net income increased from $1.9 billion in 1951 to almost $3.2 billion in 1978; exports in 1978 exceeded imports by $871 million, up from $309 million surplus in 1951; over the same time period the number of people living on farms declined from about 2.8 million to little more than one million and the total number of farms went down from 623,000 to 339,000; the average size of farms, however went up from 113 ha (of which 63 ha were improved) to 202 ha (131 ha improved).

The 1970s in particular have seen major changes in the nature of farming in Canada some of which are not yet fully apparent. Inflationary pressures since 1973 have posed great difficulties for individual farmers as increases in the costs which they face have not always been covered by increases in the prices they receive for their products. At the same time the post-war agricultural revolution has seen farmers go to college and university before beginning to farm; a farmer must, in these days, be manager, veterinarian, scientist and mechanic. Farmers wishing to expand their operations to stay competitive have been faced with steeply rising prices for land particularly where expansion of urban areas puts competitive claims on land which the farmers, in the short run, cannot hope to fight. Advances in agricultural science, engineering and institutions ensure to a large degree that the human and physical tragedies of the Dust Bowl will never be repeated in Canada. In terms of environment, however, increasing use of herbicides and pesticides, plus intensive operations such as feedlots, concern many people who regard the resulting pollution deleterious to all life.

There has also been increasing involvement by corporations (larger than the family farm) in agriculture. Usually these companies are involved in processing agricultural products and have occasionally become multi-national in scale. As the price of entering farming is more and more out of the reach of individuals these organizations have moved in to take up the slack and assure supplies to their processing plants. In line with this trend is the increasing use of food as a political weapon by governments. The family farm, however, has proved amazingly resilient and the independence and adaptability of farmers has become almost legendary.

Regional Variations and Issues in Agriculture

Lower fertility of soil is the major limitation to agriculture in the Atlantic Provinces. A tradition of mixed farming with a dependence on dairy products is maintained. Specialized production occurs in Nova Scotia's Annapolis Valley (fruits) and Cumberland County (blueberries), and potatoes in Prince Edward Island and in the Upper Saint John River Valley of New Brunswick. These three products provide the only appreciable exports. Other problems in Atlantic agriculture result from the long history of settlement in the region. There are structural defects in land-holding and tenure patterns, such as fragmented parcels of land making up a single enterprise. Reform of these problems is difficult to accomplish and farms tend to remain small, with farm incomes lower than the national average.

There is, however, considerable potential for agricultural expansion particularly to supply local markets. Only in terms of fluid milk and eggs are these provinces self-sufficient while various quantities of other food stuffs must be imported from other areas of Canada or the United States. In the case of beef and pork, local production of which could be increased, there is a significant importation from central and western Canada. Most locally produced beef is from small operators (often part-time in nature) or from dairy-herd culls. Local expansion is possible if Maritime feed-grain production can also increase. There are few physical reasons why this should not occur but the import of feed-grains from western provinces at subsidized freight rates means a competitive disadvantage for local growers.

About 95 percent of Quebec is incapable of agricultural production and less than 20,000 ha are classified as being of class 1 capability, mostly close to Montreal which puts it at a particular risk from urban expansion. There are, however, more than two million ha of classes 2 and 3 soils, mostly in the St. Lawrence Lowlands. Some of this land is used for production of fruits, vegetables and nursery products, but dairying, poultry, eggs and livestock predominate.

Agricultural production in Quebec seems adequate without being spectacular. The supply of food to major population centres such as Montreal and Quebec City means an assured market, particularly for fresh dairy products, poultry products, fruit and vegetables. Equally, the spread of low density housing in rural areas has eaten into the reserves of better quality land. As in the Atlantic Provinces there is also a long history of settlement in Quebec and the pattern of holdings is not always suitable for modern farm methods. In early 1981 the Quebec governnent adopted a land-banking scheme in an effort to protect the better areas of land for agricultural purposes.

Ontario is richly endowed with some of the best land in Canada, mostly in the triangular area of southern Ontario. High value specialized production of vegetables, fruits, tobacco, grains and oilseeds makes this one of the country's premier agricultural areas. Some soft fruits (such as peaches) are grown in an area unique outside California because of favourable soils and a localized climate made more temperate as a result of the influence of the Great Lakes. Outside these special areas dairy, beef, sheep and hog farms are widespread.

Southern Ontario is also Canada's major industrialized and urbanized area. There is stiff and unyielding competition for agricultural land for urban uses, a competition which agricultural uses cannot, in the short run, hope to meet successfully. A farmer cannot afford the several thousand dollars per hectare that a piece of cleared land can command for building purposes. Usually that land most suitable for agriculture is also that on which it is the easiest to build. Since 1945, in particular, there has also been considerable movement out of towns and cities by people who prefer to combine an urban pay packet with a rural lifestyle; to them, the daily trip to and from work is a small price to pay for a few acres away from the hustle and bustle of the city. In southern Ontario this, combined with low density expansion of suburbs, has become a problem of national importance as the highly specialized soft-fruit industry of the Niagara Peninsula has fallen prey to the march of houses and factories. The Ontario government is concerned about preserving the best foodlands but this is not supported by sufficiently authoritative planning legislation at provincial or municipal levels.

The largest single expanse of higher quality land occurs in Manitoba, Saskatchewan and Alberta. The grains grown in these provinces provide one of Canada's major exports and are a commodity of increasing economic importance in the 1970s and 1980s. These grains have also given rise to extensive livestock rearing including Canada's largest populations of beef cattle and sheep. In Saskatchewan, where two-thirds of the Canadian wheat crop is grown, agriculture is the most important industry. The province is the most rural in Canada and one in five people still lives on a farm. Alberta's feedlots, the agricultural equivalent of factories, provide a means of intensive livestrock rearing.

Prairie farmers are less concerned with the continued supply of land for farming. The Saskatchewan Land Banking Commission and Farm Ownership Act has, however, been operating since 1972 and provides a means to protect agricultural land, to inhibit foreign ownership of land, and to facilitate the transfer of farms from father to son. The marketing of agricultural products is, however, a much larger issue particularly because of the national exports involved. In many cases the problem is one of moving grain efficiently and rapidly from farm to railroad to port of export (usually either Thunder Bay or Vancouver). Small rural branch railways can no longer move the grain efficiently which means farmers must travel over greater distances to reach elevators to load their grain onto railcars. Suitable railcars are in short supply in spite of increasing investment by governments in fleets of hopper cars. Main lines are still only single-track over large distances. large distances.

There is in addition the perennial problem of the Crow's Nest freight rates, a structure of rates which dictates the price of moving grain by rail to Thunder Bay or the West Coast. The rate structure was established in partial recompense for the high tariffs which protected eastern industries in the years after Confederation; it has been operating since 1899 for grain to Thunder Bay and since 1927 to the West Coast. The actual rates set were artificially low to benefit farmers and the charge to farmers has not changed since 1925 – one half cent to move one ton of grain one mile. On the other side of the coin are the railways who cannot hope to make money (and thus reinvest to improve service to farmers) at such a low rate. Present estimates indicate the railways lose $200 million annually moving grain. The pressure for change from the railways has been fierce as has the opposition to change by the farmers. Only slowly are the farmers realizing that the Crow's Nest structure must change to reflect the economic reality of moving grain to markets and the effects any increased shipping charges will have in exports may be significant.

Agriculture in British Columbia is confined to small areas of valley bottoms. It is, however, a major industry because of the high value crops grown, including many orchard crops. The rapid spread of urban areas onto farmland prompted a radical attempt to protect this farmland in 1972 when all development was effectively prohibited. This allowed authorities to identify and designate a series of Agricultural Land Reserves and extended considerable protection to these areas in their existing use as farmland by the establishment of a Land Commission. Much controversy still surrounds this move. A farmer's land is often regarded as his "pension fund". Whereas an industrial worker, for example, can usually rely to a certain extent on a pension from his employer when he retires, the self-sufficient farmer cannot look forward to this income. Instead he must rely on selling his land to finance his retirement. Particularly, when urban centres are close, such transactions do not always involve farmer-to-farmer sales but more often to developers and speculators. To help provide farmers with the means which most other people take for granted the Land Commission Act was supplemented by a Farm Incomes Assurance Act in British Columbia. Opponents of this system make charges that interference with one part of the economic system has effects which necessitate adjustments in other parts of the system and the resulting inefficiencies are unavoidable.

The Management of the Land Resource

Land and soil are basic to agriculture and the management of these resources poses a major challenge. The experience of British Columbia in land use management is being closely watched by other provinces. Land use planning generates conflicting and intense emotions. The original settlers of North America were largely drawn by the promise of land in abundance. Frequently these settlers had been dispossessed in the old country and their descendants today feel as strongly as their ancestors did about private ownership of land. This concept is, in fact, central to the North American ideal and as a result land use management has lagged far behind that in many European countries. With increasing concern over the conflict between agricultural and urban uses of land, however, economic forces alone may not be enough to promote the best uses.

Land-use planning in some form exists for all provinces, mostly oriented in the provision of community services and facilities in urban areas. British Columbia, Saskatchewan, Ontario and Quebec each have adopted laws or policies to protect agricultural land and other provinces are working to this end. There is a feeling that economic forces alone cannot always result in the highest and best use of land. As Toronto expands the produce which used to be grown on the land taken over by houses, roads and factories must come from elsewhere. Trade makes this process quite simple but extra costs for transportation are incurred and lines of supply of the most basic necessities are extended. Frequently replacement produce comes from foreign countries thus involving a balance of payments element. The problem of private rights in land and "common good" is highly intractable but resolution of the problem will involve the future of a major national asset, agricultural land.

Fishery Resources: Freshwater

Compared to the marine fisheries Canada's freshwater fisheries are small but in 1978 they were still worth almost $33 million in landed values, an increase from $19 million in 1973. Major species are whitefish, yellow pickerel, yellow perch and smelt. The freshwater fishery is also an important index of surface water quality and as such is a significant consideration in river basin management.

The two major centres of the fishery are Ontario (mainly from the Great Lakes) and Manitoba, but with important contributions to local economies in Saskatchewan, the Northwest Territories, Alberta, Quebec and New Brunswick. Commercial sales are supplemented by contributions made during sport-fishing seasons which have become synonymous with the onset of spring-fever in Canada. As long ago as 1970, Canadians spent more than $100 million on sport-fishing and non-Canadians were estimated to have spent more than twice as much while fishing in Canada.

There is considerable potential for expansion in all aspects of inland fishing depending mainly on access to many remote areas and maintenance of environmental quality everywhere.

Fishery Resources: Marine

The abundance of cod on the Grand Banks of Newfoundland brought the first semi-permanent European settlement to what is now Canadian soil. Portuguese fishermen set up communities to dry the fish in the sixteenth century before taking them to market in Europe. Canada's Atlantic waters are still one of the major resources of fish in the world. In this area a series of extensions of land, the Continental Shelf, provide an ideal habitat for growth of many species of fish on a series of banks. Upwelling currents from deeper water bring nutrients to sustain fish and the relative shallowness of the banks makes the catching of these fish easier. The Pacific coast fishery is no less important.

In spite of such an abundance of resources production from Canadian fisheries is relatively insignificant in global terms. In 1977 Japan landed almost 11 million tons of fish compared to 1.3 million tons by Canada. The Soviet Union, China, Norway and the United States all had significantly larger catches than Canada. Exports from Canada, however, in terms of value were second only to those from

Norway. Fish accounted for US $757 million in exports from Canada in 1977.

Much of the world relies to a far greater extent than Canadians on fish for essential protein supplies. In Japan fish of all types provide about 50 percent of protein requirements. Consumption of fish in Canada in 1978 was 7.4 kg per person compared to almost 50 kg of beef per person and this preference for meat is one reason that the fisheries still rely to a great extent on exports for growth.

The Atlantic fishery dominates total catches with more than 1.1 million tons worth $416 million at dockside in 1978. The Pacific coast catch, however, although less in terms of weight is worth more per unit; in 1978 it was valued at dockside at $1269 per ton as against $361 per ton on the East Coast. Salmon make up a high proportion of total Pacific catches (35 percent) and command a high price. In addi-

Figure 4-1

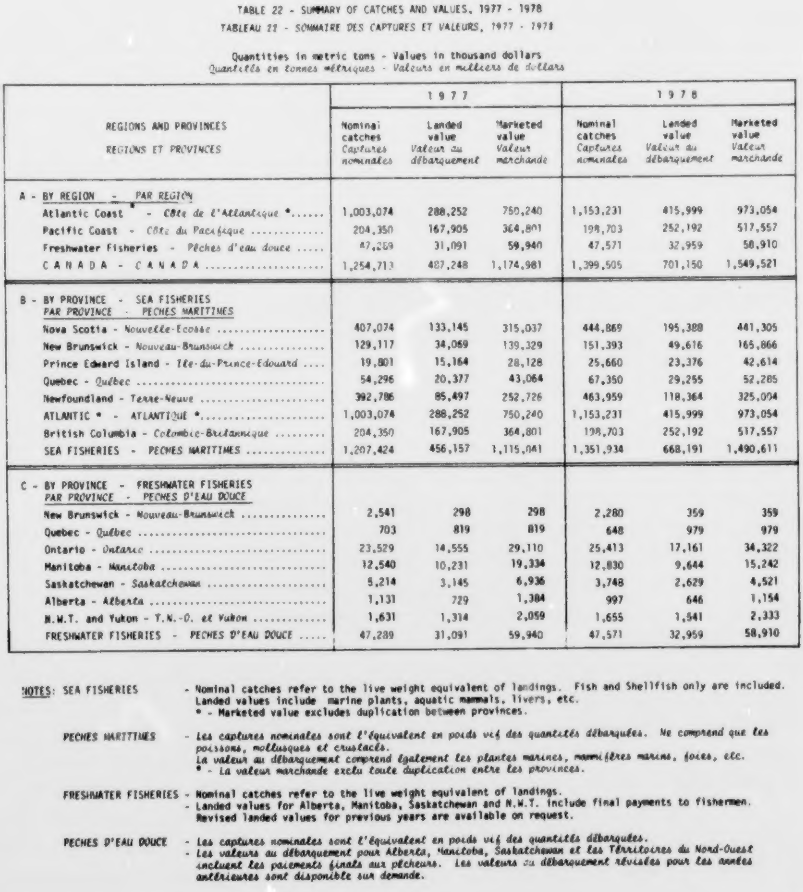


TABLE 22 - SUMMARY OF CATCHES AND VALUES, 1977 - 1978

TABLEAU 22 - SOMMAIRE DES CAPTURES ET VALEURS, 1977 - 1978

Quantities in metric tons - Values in thousand dollars

Quantités en tonnes métriques - Valeurs en milliers de dollars

REGIONS AND PROVINCES *REGIONS ET PROVINCES*	1977			1978		
	Nominal catches *Captures nominales*	Landed value *Valeur au débarquement*	Marketed value *Valeur marchande*	Nominal catches *Captures nominales*	Landed value *Valeur au débarquement*	Marketed value *Valeur marchande*
A - BY REGION - *PAR REGION*						
Atlantic Coast - *Côte de l'Atlantique* *	1,003,074	288,252	750,240	1,153,231	415,999	973,054
Pacific Coast - *Côte du Pacifique*	204,350	167,905	364,801	198,703	252,192	517,557
Freshwater Fisheries - *Pêches d'eau douce*	47,289	31,091	59,940	47,571	32,959	58,910
CANADA - *CANADA*	1,254,713	487,248	1,174,981	1,399,505	701,150	1,549,521
B - BY PROVINCE - SEA FISHERIES *PAR PROVINCE - PECHES MARITIMES*						
Nova Scotia - *Nouvelle-Ecosse*	407,074	133,145	315,037	444,869	195,388	441,305
New Brunswick - *Nouveau-Brunswick*	129,117	34,069	139,329	151,393	49,616	165,866
Prince Edward Island - *Ile-du-Prince-Edouard*	19,801	15,164	28,128	25,660	23,376	42,614
Quebec - *Québec*	54,296	20,377	43,064	67,350	29,255	52,285
Newfoundland - *Terre-Neuve*	392,786	85,497	252,726	463,959	118,364	325,004
ATLANTIC * - ATLANTIQUE *	1,003,074	288,252	750,240	1,153,231	415,999	973,054
British Columbia - *Colombie-Britannique*	204,350	167,905	364,801	198,703	252,192	517,557
SEA FISHERIES - *PECHES MARITIMES*	1,207,424	456,157	1,115,041	1,351,934	668,191	1,490,611
C - BY PROVINCE - FRESHWATER FISHERIES *PAR PROVINCE - PECHES D'EAU DOUCE*						
New Brunswick - *Nouveau-Brunswick*	2,541	298	298	2,280	359	359
Quebec - *Québec*	703	819	819	648	979	979
Ontario - *Ontario*	23,529	14,555	29,110	25,413	17,161	34,322
Manitoba - *Manitoba*	12,540	10,231	19,334	12,830	9,644	15,242
Saskatchewan - *Saskatchewan*	5,214	3,145	6,936	3,748	2,629	4,521
Alberta - *Alberta*	1,131	729	1,384	997	646	1,154
N.W.T. and Yukon - *T.N.-O. et Yukon*	1,631	1,314	2,059	1,655	1,541	2,333
FRESHWATER FISHERIES - *PECHES D'EAU DOUCE*	47,289	31,091	59,940	47,571	32,959	58,910

NOTES: SEA FISHERIES - Nominal catches refer to the live weight equivalent of landings. Fish and Shellfish only are included. Landed values include marine plants, aquatic mammals, livers, etc.
* - Marketed value excludes duplication between provinces.

PECHES MARITIMES - Les captures nominales sont l'équivalent en poids vif des quantités débarquées. Ne comprend que les poissons, mollusques et crustacés.
La valeur au débarquement comprend également les plantes marines, mammifères marins, foies, etc.
** - La valeur marchande exclu toute duplication entre les provinces.*

FRESHWATER FISHERIES - Nominal catches refer to the live weight equivalent of landings.
- Landed values for Alberta, Manitoba, Saskatchewan and N.W.T. include final payments to fishermen. Revised landed values for previous years are available on request.

PECHES D'EAU DOUCE - Les captures nominales sont l'équivalent en poids vif des quantités débarquées.
- Les valeurs au débarquement pour Alberta, Manitoba, Saskatchewan et les Territoires du Nord-Ouest incluent les paiements finals aux pêcheurs. Les valeurs au débarquement révisées pour les années antérieures sont disponible sur demande.

tion the Pacific fishery, some have argued, is more efficient than the Atlantic with fewer, larger, better equipped boats.

Development of fishery resources is subject to special problems. For a long time it has been regarded as a common-property resource with open and free access. Consequently this means that the fish, often a resource which is highly mobile and migratory, are not the management responsibility of anyone in particular and individual fishermen have little incentive to conserve and sustain the resource in the way a farmer, for example, will sustain his land for future years. On the East Coast this has had the consequence of the ships of many nations chasing a reserve of fish which is subject to strict natural, biological and environmental laws which must be respected if it is to be maintained as a renewable resource.

The plight of the Atlantic salmon is a graphic example of how a single species can be severely depleted in the absence of an acceptable management policy. The salmon breeds in the headwaters of many rivers which flow to the Atlantic and it travels to salt water to mature and grow. This means an individual salmon passes in turn, at several times during its life, through several jurisdictions. Major feeding grounds are off the southern tip of Greenland. From here mature salmon move by an extraordinary sense of navigation to the very stream where they were spawned hundreds of miles away. At all stages of this trip there are risks of being caught; off Greenland there is an extensive Danish fleet; large numbers are caught in Canadian coastal waters and when they reach fresh water, not always legally. Even within Canadian jurisdictions there are conflicts as the activities which disrupt spawning habitat, such as forestry operations and flood control, are largely the responsibility of the provinces and the fish are the responsibility of the federal government.

All these claims on a finite and limited resource severely reduced stocks of the Atlantic salmon. Aided by a ban on commercial fishing in Canadian coastal and fresh water, they are only slowly recovering. There has also been agreement with the Danish government to limit catches off Greenland, but only after much patient negotiation. Management of the salmon is still, however, very difficult because of the distance of its range and the cost of policing such a wide area and variety of habitats. Although this may be an extreme example, it serves to highlight the overall management problems in Atlantic waters.

Since 1949 the International Commission for the Northwest Atlantic Fishery (ICNAF) undertook management of fishery resources in eastern Canadian waters. This was a thankless task which involved reconciling the claims of countries as diverse as Cuba, the United States, Japan, and the Soviet Union and much of the management of the resource was reduced to an inadequate lowest-common-denominator: the concept of maximum sustained yield. By applying this concept, a fish stock would, in theory, be caught up to the point where natural increase of the stock was not replacing the amount of the catch so overall the stock began to decline. There were many arguments against this concept, notably that the precise point of maximum sustained yield was impossible to define as fish rarely behave in a simple and predictable way. There was also the economic argument that the maximum sustained yield was inefficient as the cost of locating and catching the last unit of fish far exceeded the revenue that fish would bring when sold; in other words, marginal cost far exceeded marginal revenue.

The federal government issued a policy for Canada's commercial fisheries in 1976 which effectively replaced maximum sustained yield as a management tool with a concept called "best use" which, for the first time, managed the overall fishery not only in biological terms but also in socio-economic terms. It was recognized explicitly that the human dimension of the fishery (fishermen, people working in fish-processing factories and their families) should not only be acknowledged but should be a prime concern in management policy.

The contrasts between Pacific and Atlantic Coasts are particularly sharp in terms of the communities which have evolved around the fishery resource. The 1976 policy recognized that 50 percent of all fishermen in Canada earned less than $5,000 annually and that of this proportion 20 percent were residents of the Pacific Coast and 60 percent of the Atlantic Coast. In none of the Atlantic Provinces was the proportion of fishermen earning more than $10,000 greater than 12 percent. There were many part-time and occasional fishermen in the Atlantic Provinces who relied for at least part of their annual income on other types of work or on transfer payments from governments. Fishing in Atlantic Canada, however, is a major industry; in Newfoundland it accounts for almost 15 percent of the total labour force, including many women; in Nova Scotia for every job created (or lost) in fishing 0.7 jobs are created (or lost) elsewhere in the provincial economy. A large number of Atlantic coastal communities are dependent solely on fishing.

The 1976 policy could not work without one major development – the extension of Canadian management jurisdiction to 200 miles (322 km) offshore. The declaration of this Economic Management Zone (EMZ) by most coastal states in the world in 1977 or 1978 was a major step toward subjecting fishery resource to more efficient management procedures. The Canadian Fisheries and Oceans Department assumed the management role previously carried out by ICNAF over large areas. This step is not, in itself, without problems and Canada still must resolve conflicts with the United States on both coasts over where each country's jurisdiction ends. The politics of this issue are complicated in areas like Georges Bank by the search for offshore oil and gas deposits.

More serious are the problems associated with the structure of the fishing industry, particularly in the Atlantic. The Pacific fishery is fairly modern and homogeneous, based in a single province and dependent on relatively few species; in 1978 the various species of salmon (sockeye, coho, pink and chum) and herring accounted for 76 percent of total catch by weight and 85 percent of landed value. The Atlantic fishery is much more complex. Five provinces are involved, catching a much larger variety of species, from a large variety of vessel sizes, using many types of gear, at varying distances from land. The inshore lobster boat contrasts with the offshore freezer-trawler with its electronic equipment to assist in locating schools of fish. On the Fundy Shore of New Brunswick herring are taken using fixed weirs which trap the fish using the large range in Fundy tides, whereas the purse-seine fleet based in Yarmouth, Nova Scotia uses depth-sounders and sonar equipment to find shoals of herring. Cod are taken using fish traps very close to shore in Newfoundland and also by using modern stern trawlers further offshore. In spite of the small scale of operation which dominates the lobster fishery the landed value of catches from this fishery is equivalent to that of the offshore ground fishery (cod, haddock, flatfish, etc.) and far exceeds the value of pelagic catches (fish such as herring, mackerel and salmon which are caught in the water column above the sea-floor).

The problem of balancing the interests of all fishermen is immense. Although the Atlantic coast fleet is largely made up of small, owner-operated boats, the larger, deep-water boats, owned often by fish processors, are taking an increasing part of the catch. There are pressures to increase the freezer-trawler fleet on the grounds that economic efficiency and quality control demands the use of such vessels offshore. Inshore and smaller fishermen say that this would discriminate against them because only corporations would be able to afford expensive freezer-trawlers and the increased offshore effort would deplete inshore stocks of those species which migrate between the two zones. It must also be remembered that the closed food-web system of the seas is particularly vulnerable to interference, and increased harvest of one stock may mean a decreased food supply for another species.

Foreign vessels are still active within Canadian waters under stricter control than in ICNAF days and they can normally only catch species classified as "underutilized" for Canadian purposes. They may be underutilized for one of several reasons such as little demand in the North American market and consequently few domestic processing facilities. But the fact that they are caught by someone indicates that there is a market somewhere. The large and lucrative Japanese market for squid is supplied in part from Canadian waters, but much of this supply is sold to the Japanese by non-Canadian vessels. A Canadian resource, therefore, is doing little to benefit the people who ostensibly own that resource. The policy of "over-the-side" sales for foreign buyers by fishermen may help to redress the balance.

These problems in the Atlantic Coast fishery are intractable. A rapid expansion of the freezer-trawler fleet would probably result in the effective closing of entire communities which rely on smaller-boat fleets. This would negate the "best use" doctrine of the 1976 policy. The increased activity in searching for offshore oil and gas means the increased risk of environmental catastrophe in the unfriendly waters of the North Atlantic. Much of the benefit of ownership of a resource such as this is presently being frittered away by these problems.

It is true, however, that the policy and the EMZ are still very young. The resolution of the problems will be an indicator of the maturity of both the political process in Canada and the fishing industry. In the face of the increasing global demands for protein it would be difficult to justify prolonging the disputes for any longer than necessary. In the same vein it can be argued that Canada has a responsibility to the rest of the world to be an efficient and prolific producer of food from both land and sea.

5

Energy Resources

Few topics characterized and dominated the 1970s more than energy supplies. Two circumstances in the early part of the decade contributed to this global concern. The United States, as the major consuming nation, was increasingly dependent on foreign supplies as domestic demand far outstripped supply and the Organization of Petroleum Exporting Countries suddenly flexed its political and economic muscles. Within 12 months in 1973 and 1974 it increased the price of a barrel of oil five times, from US $2.20 to US $11.50. This was just the beginning and by 1980 the price of OPEC oil was more than US $30 a barrel.

Canada is fortunate in being a net exporter of energy and having the potential to be totally self-sufficient in energy supplies. Reserves, however, are not uniformly spread throughout the country and patterns of trade which have developed in energy mean that eastern Canada is largely dependent on imports.

Perhaps no other resource better illustrates the mixture of economics and politics. Demand for energy will increase despite conservation efforts and countries (and provinces) with energy reserves are therefore unlikely to moderate their insistence on high prices. As the price increases an economic system based on cheaper energy supplies feels the bite of inflation which is a politically unsettling force. In global terms the more powerful take steps to assure their supplies of energy. As prices increase an exciting series of options to conventional supplies becomes available.

Modes of Occurrence

Almost all of the energy used on the earth comes from the sun. The figures alone are impressive. The total solar radiation intercepted by the earth is 173 quadrillion watts (17.3×10^{16}). Almost half of this (47 percent or 8.1×10^{16} watts) is absorbed by the earth's surface and atmosphere; about 23 percent (4×10^{16} watts) is accounted for by the hydrologic cycle; the remaining 30 percent (5.2×10^{16} watts) is reflected back into space as short-wave radiation. Apart from solar radiation there are two other sources of energy which in total account for 0.02 percent of the total supply, seemingly insignificant except in view of the large absolute numbers involved. Terrestial energy (the flow of heat from the earth's interior by conduction in

Figure 5-1

Canadian Trade Balances in Energy Commodities

					Uranium		
Year	*Petroleum**	*Natural Gas*	*Coal & Coke*	*Electricity*	*Ores etc.*	*Elements & Isotopes, etc.†*	*Total Net Exports*
				($ millions)			
1966	−105	91	−144	6	36	2	−115
1970	129	201	−135	22	26	−60	183
1971	172	244	−83	37	18	−5	383
1972	344	299	−90	59	40	15	667
1973	647	343	−9	103	64	5	1,153
1974	1,045	488	−84	170	51	33	1,702
1975	171	1,084	−160	91	51	70	1,307
1976	−624	1,607	−13	153	67	174	1,364
1977	−1,065	2,028	−66	362	75	133	1,467
1978	−1,199	2,190	−8	477	207	439	2,106
1979	−557	2,889	−184	728	379	590	3,844

SOURCE: Statistics Canada, *Exports—Merchandise Trade*, Annual, Cat. 65-202, and *Imports—Merchandise Trade*, Annual Cat. 65-203.

*Includes liquefied petroleum gases (net export of $525 million in 1979). Also includes several non-energy petroleum products. In 1979 imports of these products amounted to $153 million while exports totalled $21 million, for a net import of $132 million.

†This category includes items with both energy and non-energy uses. Unfortunately, no more detailed breakout is available that would permit a more precise estimate of trade in purely "energy" commodities produced by the nuclear industry.

rocks or convection by hot springs and volcanoes) contributes 3.23 x 10^{13} watts to the picture; and tidal energy (the combined potential and kinetic energy of the positions of the earth, moon and sun relative to each other) is estimated at 3 x 10^{12} watts.

Sunlight (the major single source of energy) is absorbed by plants in a process known as photosynthesis in which carbohydrates are created from light and air. Plants when dried out will burn and thus release the energy stored in them. Alternatively these plants can transfer their energy to animals when eaten and thus the food chain becomes a flow of energy which ultimately sustains the human body and mind. If the plant is neither burnt nor eaten the energy locked in it is not used as energy. Immense quantities of carbon have been stored up over hundreds of millions of years during times and conditions of lush plant growth far in excess of contemporary demands. These primeval forests, representing stored sunlight, have been preserved as coal fields, often deep in the earth.

It is evident however that enormously long periods of time are required for such "fossil fuels" to replenish themselves and certainly the rate at which they have been used in the industrial age far exceeds this replenishment process. In human terms, therefore, these reserves of energy are non-renewable. But even before the age of steam, which greatly increased the demand for coal and oil, the so-called renewable energy resources were important. Chief amongst these are wind, water and wood and all three are presently being seriously re-examined as energy sources.

The use of all three as energy involves problems. With wind there are storage problems as demand for energy rarely coincides with the supply of wind. Water power potential, including hydro-electricity, is often far from centres of demand and requires huge capital resources to realize the potential. Wood as fuel may conflict with many other demands on the resource, such as for paper or lumber.

Two other sources of energy deserve special mention. Firstly, there is the conversion of solar radiation directly to energy in a usable form. The use of banks of photovoltaic cells makes this possible. There are problems with storage (as with wind power) and of matching periods of maximum solar energy in any given place with periods of maximum demand. Many parts of Canada receive most sunlight in summer, whereas maximum demand for energy tends to be for heating purposes in winter. It is likely that if solar power becomes popular in Canada it will be on a building-by-building basis and may largely be confined to individual family dwellings. There are, in fact, doubts whether even a well-designed home could be powered by solar cells alone in our northern latitudes.

Secondly, there is the power which moves the tides. The differential gravitational pulls of the sun and moon relative to the earth cause tides in the first place. Certain types of coastal features and configuration of land and sea may amplify these tides. In the Bay of Fundy, Canada possesses the highest range of tides anywhere in the world and the difference between low and high tide can vary up to almost 16 metres. The dream of harnessing these tides has been alive almost as long as men have lived around the Bay but there are financial, environmental and technological problems on a scale which rivals landing men on the moon. Again there is the problem of matching the maximum supply of energy (determined by the tidal cycle of about 6 1/8 hours in, 6 1/8 hours out) and periods of maximum domestic and industrial demand. Because this potential occurs, however, in an area of chronic economic depression, high unemployment and, furthermore, with a hefty energy deficit, the dream is not only alive but is being actively pursued in the form of a pilot project in the Annapolis Basin of Nova Scotia.

Energy Demand and Supply in Canada

As nations have reached an advanced stage of industrialization so their demands for energy have increased astonishingly. The primitive man of one million years ago consumed an estimated 2000 kilocalories each per year; when he became the hunter of 100,000 years ago, which involved the use of primitive weapons, this consumption per person had increased to 4000 – 5000 kilocalories; the first farmers of 5000 BC increased their output and productivity by applying more energy to production, an estimated 12,000 kilocalories each per year; the "advanced" farmer of 1400 AD consumed 26,000 kilocalories each per year; the steam engines of 1870 allowed men to produce greatly increased amounts of goods and services but only by consuming about 70,000 kilocalories of energy per person per year; the North American of the 1970s, with his automobiles, electrical appliances, climate controlled homes, high technology industry, and huge output of all varieties of goods and services, consumed an average of 230,000 kilocalaries per person per year.

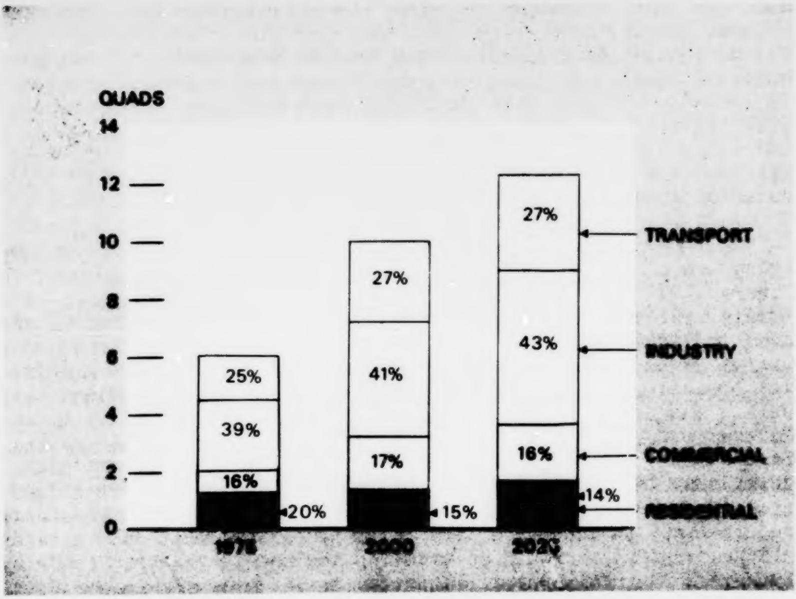
The higher the stage of technological and economic development, therefore, the greater the consumption of energy. Canadians are in the forefront of energy consumption because of several circumstances. They have much industry, they own many automobiles and home appliances, they live in a climate which necessitates much warming of homes in winter, there are large distances to be covered within the country and much of the progress of their society since 1945 has taken place in a world of relatively cheap energy. As the Canadian population increases the demand for energy can only be cut back within certain limits. As the world's population bounds forward and industrialization increases there will be many other claims on limited energy supplies and, therefore, Canadians will increasingly be forced to look to domestic supplies of energy.

Hydrocarbons

The price paid for oil has dictated the price paid for all types of energy in a society which based its post-war growth and expansion on the availability of cheap oil. Petroleum and natural gas often occur together and Canada has abundant supplies of both, but only at a price. The first Canadian commercial oil well was drilled in Lambton County, Ontario in 1857 and by 1880 this area of Ontario around Sarnia had become an important oil producing and refining area. The petrochemical industries of Sarnia are still important.

As demand for oil and gas increased so did the production of an irritating by-product called gasoline. The solution to this problem came with the introduction and rapid spread of the internal combustion engine. In 1914 the first significant oil field in Alberta, at Turner Valley, was in production, mainly for natural gas. Norman Wells in the Northwest Territories was the site of the first discovery of crude oil in western Canada in 1919, though in 1780 Alexander MacKenzie had noted the presence of oil seeping to the surface in this area. Further efforts around Turner Valley yielded more reserves of oil and gas up to

Figure 5-2



4-3. Energy demand by principal uses, 1975, 2000, 2025.

the Second World War but no significant discoveries came before Leduc, outside Edmonton, in 1947.

The success of the search for oil and gas at Leduc underpins much of the post-war growth of western Canada in particular and the whole country in general. It proved conclusively that huge deposits were there for the finding and therefore spurred exploration efforts. It gave rise to refining and associated industries in the west and elsewhere. The Redwater field was discovered in 1948, Sturgeon Lake in 1952 and Pembina in 1953. This last was particularly important because of the size of the reserves (first estimated at more than 1 billion barrels) and because it was away from the geological area of Leduc and associated discoveries.

The dominance of Alberta's oil and gas reserves in the Canadian picture has been all but absolute. As a result of the post-1973 OPEC-induced price increases there has been a significant movement of economic activity to the west. As the industries of the eastern provinces have suffered from inflation and economic depression caused by the higher price of energy, so Alberta has experienced a succession of booms. This economic prosperity is showing few signs of slowing down and is enhanced by the presence of Canada's major coal reserves in Alberta.

Oil represents the remains of aquatic organisms from many millions of years ago. It occurs in porous strata trapped between impervious strata. Such sedimentary strata occur widely across Canada, both under the land and under water. With the exception of the ancient rocks of the Shield, the slightly younger rocks of the Appalachian remnants in Nova Scotia and Newfoundland, and many of the young rocks of the western Cordillera, there are large areas of Canada in which hydrocarbons might reasonably occur. At a level of 90 percent probability of occurrence there are an estimated 4 billion m^3 (25 billion barrels) of oil in Canada, mostly in the west, north and in offshore Atlantic waters. If a 50 percent level of probability is adopted the reserves increase by almost 5 billion m^3 (31.4 billion barrels). At these two levels of probability of occurrence also are estimated reserves of natural gas of 6.5 trillion m^3 and 6.4 trillion m^3 respectively.

Many problems are posed by the development of these resources. The increase in prices during the 1970s has been the catalyst to spur exploration in remote areas with "unconventional" reserves. The Arctic areas, in particular the Beaufort Sea, have been the object of billions of dollars worth of exploration activities, as have the shelf areas under the Atlantic off Newfoundland and Nova Scotia. Oil and gas have been discovered in both efforts and in each area the development of these deposits will have widespread ramifications in both economic and environmental terms.

Development of Arctic reserves will be very costly and a host of new problems must be solved. There are severe climatic constraints in exploration, development, production and transportation phases. When drilling operations began in the Beaufort Sea in 1975 this could only be carried out during a 75-day long season. The capital costs per barrel of capacity can vary up to 100 times more than in southern Alberta. Operating in ice demands special design standards capable of withstanding huge pressures. Sub-sea well-heads must be kept under open water year-round to allow access in case of blow-outs. Frontier oils are remote from markets and transportation costs are, therefore, high. There are presently no tankers built large enough to ensure economic operation which have ice-breaking capabilities. Transportation by either tanker or pipeline involves the risk of major spills and consequent environmental catastrophe in regions with fragile ecosystems.

In offshore Atlantic areas there is equal excitement over oil and gas deposits, given extra poignancy because of the severe economic problems of the region. The north-west Atlantic at least matches the North Sea for mountainous seas and there is the added hazard of icebergs threatening drilling platforms. One well with proven flow, Hibernia, estimated development costs of $3 billion in 1981 dollars for an output of 200,000 barrels per day. To make the well economic, however, the oil had to be sold for close to the 1981 OPEC price which was higher than the price set by the federal government for Canadian domestic oil.

Other types of hydrocarbon deposits also contain enormous amounts of energy in Canada. Oil sands in northern Alberta are coarse-grained sedimentary deposits saturated with oil. To extract the oil the sands must be "squeezed" by an enormously expensive process. Once again under the influence of world prices these deposits have become attractive enough to justify building huge plants to extract the oil around the headwaters of the Athabasca River. The sands can be quarried, which involves special problems of restoring the landscape once quarrying has been completed. Estimates of these reserves add more than 150 billion m^3 (943 billion barrels) to Canada's reserves. Heavy oil deposits are associated with tar sands in Canada and contain oil much more viscous than the lighter crude oils. Extraction would involve "oil mining", a process by which steam is pumped down to the oil reservoir to make the deposit sufficiently fluid to flow easily to the surface under pressure of the steam. This process is in itself very costly in terms of energy.

Coal

There is more energy stored as coal in Canada than either oil or natural gas but once again deposits are highly imbalanced with an estimated 99 percent occurring in Alberta, British Columbia and Saskatchewan. There are indications also of significant deposits in northern areas. Locally important deposits are exploited in Nova Scotia and New Brunswick. Total reserves of "recoverable" coal for standard uses (for coking or thermal plants) were estimated at almost 6 billion tonnes in 1976.

Coal essentially fueled the Industrial Revolution in Britain in the eighteenth and nineteenth centuries and is still important in the iron and steel industries. The era of cheap oil meant a decline in the use of coal but the higher prices for oil means that coal is once more taken seriously as a source of energy. Nova Scotia, long dependent on foreign oil for its thermal electricity generating plants, built two new coal-fired power stations in the late 1970s to lessen this dependence and to ensure a market for Cape Breton coal. Western deposits are increasingly being exported to countries such as Japan.

There are different qualities of coal ranging from anthracite (the "purest" form) through several bituminous classes to sub-bituminous and lignite. The higher up the scale a deposit occurs the higher the caloric value. In environmental terms the purer the coal the less likely it will add to air pollution. A major concern emerged towards the end of the 1970s with acid precipitation in North America. Many of the sulphur and nitrogen oxides which combine with rainwater to form weak solutions of sulphuric and nitric acid originate from thermal power plants which generate electricity for the populations of central Canada and the central and eastern United States. The prevailing west-east air flow across North America means that eastern parts of the continent receive these emissions as acid rain or snow. The effects on the life in rivers and lakes are causing great concern as the pH levels indicate increasing acidity. The problem is particularly acute in the lakes and rivers of eastern Ontario, Quebec and the Atlantic Provinces.

Most of the coal deposits in Canada are highly volatile bituminous, sub-bituminous or lignitic in character and this would contribute, often alarmingly, to acid precipitation unless modified combustion methods are adopted. Such methods exist but are sufficiently new to make them still quite expensive. The American deposits of coal, also, tend to be lower grade and the expansion in output which has already begun in the western states can only aggravate an already serious situation.

A further concern with expanding coal output is modern methods of extraction. In the west the deposits either occur close to the surface or in areas where mountain-building has exposed seams along the sides of valleys. This coal will be extracted by surface mining in pits and the effects on the landscape are usually enormous unless expensive restoration takes place as soon as the coal is taken out. More than 15,000 ha of land were affected in 1978, mostly in Alberta. As well as aesthetic effects there is concern over effects on the hydrologic cycle.

Hydro Electricity

Some 70 percent of Canada's production of electricity in 1978 came from falling water as against 14 percent from coal and 4 percent each from oil and natural gas. Most of the installed capacity for hydro generation is in Quebec, Ontario, British Columbia, Newfoundland and Manitoba. The size of installations varies from very small to some of the largest construction projects ever undertaken anywhere.

The construction of a hydro station requires certain physical conditions, such as ample year-round water flow or an area which can be damned easily and economically. Most such sites within easy reach of population centres have long since been used and any expansion in this mode of power must be in remote areas. In northern mountainous areas rivers either have had much less time to level out into gentle streams or flow over rocks which make this process much more difficult because of their resistance to erosion.

Modern additions to hydro generators, therefore, have been big and remote including such projects as Churchill Falls in Labrador, James Bay in Quebec, and the Churchill-Nelson project in Manitoba. These projects, and others of similar scale, require very large headponds and much land upstream is inundated. In the James Bay project some 8,000 km^2 of land will be affected including land traditionally hunted and fished by Cree Indians. Environmental effects are bound to be significant. Sedimentation patterns behind the dam will be changed. Construction of the dam itself, with its generating capacity, necessitates temporary housing for workers and areas where population density is measured in terms of square kilometres per person suddenly play host to a new town. Roads built to service the dam site encourage searches for other resources. Migration routes for fish may be blocked. The electricity generated must reach market through many miles of high voltage transmission lines. Although these power lines have become a part of the Canadian landscape (there are more than 167,000 km nationwide) few people would regard them as aesthetically desirable.

In spite of reservations over the effects of construction of hydro projects, particularly the "mega-projects" of recent years, this form of energy is regarded as a valuable addition to Canadian energy resources. Export of some of the power generated is essential to justify the immense capital investment involved and Canada's location relative to a major market in the United States is an advantage in this respect. The importance of this market to the south indeed cannot be ignored in most energy developments in Canada.

Nuclear Power

This controversial form of power generation is seen as solving some of Canada's problems of dependence on foreign energy. There are abundant resources of essential minerals such as uranium and thorium, and a sophisticated technology, developed in Canada, to refine the ores and generate power. Most interest has been shown in this form of generation by Ontario, traditionally an energy deficient province, with 5,600 MW of capacity in 1978. Quebec also has capacity and New Brunswick completed its first nuclear power station in 1982.

Sedimentary deposits in which uranium can be found are widely dispersed around Canada and ore is presently extracted at three locations in Ontario and two in northern Saskatchewan. There are proposals to add more mines in Saskatchewan, in British Columbia and in Labrador. All these mines are in isolated communities. Milling of the ore usually takes place at the mine site but essential upgrading to obtain refined fuel is concentrated at Port Hope in Ontario. There are enough reserves to supply both domestic and export demands and export efforts are linked significantly to the simultaneous export of the Canadian reactor system CANDU.

Nuclear reaction produces energy by both fission and fusion processes; the former involves splitting atomic nuclei, the latter combining two atomic nuclei. In both reactions the mass yielded is less than the respective masses of original nuclei and the lost mass is given off as energy. In terms of air and water pollutions this method of power generation is clean.

Major concerns centre on the devastating effects of radio-active materials on human health. These can occur at several stages in this process as mining, milling, refining, reaction and waste disposal all involve risk. The probability of this risk becoming reality is open to considerable question. There is undoubtedly a "human element" in nuclear power generation which defies the best attempts of man to make this form of energy completely safe. Failure of systems could affect millions of lives in both the short and long runs by exposing them to radiation sickness. The problem of disposal of irradiated waste which have accumulated in filters and so on is especially serious as the "hot" materials must remain undisturbed for cooling periods of up to millions of years. In spite of many misgivings, however, it is likely that nuclear power generation will become more and more important in Canada.

Renewable Resources

The interest in forms of energy which involves less dependence on outside influences bear a direct relationship to the price of oil. This interest has usually involved serious consideration of independence on a much smaller scale such as factory, school or household. Systems for the generation of power from solar, wind and biomass sources have involved considerable attention to individual needs. In the case of solar and wind power there are problems in providing energy on a large scale; to replace the Pickering nuclear plant in Ontario, with a capacity of 2,000 MW, would require 60,000 windmills which would cover a large amount of land. There are, in addition, physical problems in Canada particularly in assuring continuity of supply. Most individual systems could not rely entirely on solar or wind power and design would involve backup systems incorporating more conventional power.

Energy from biomass involves the retrieval of sunlight from a variety of sources where it is stored by photosynthesis. The range of materials varies from trees to agricultural and industrial wastes. The attraction of this source of power in a country with large reserves of woodland and large amounts of waste materials from a wide variety of sources is evident. There are numerous examples of individual industrial plants presently generating part of their own power needs by "recycling" waste by-products. In Montreal, Quebec City and Hamilton, garbage incinerators provide part of each city's power needs but these and other examples are regarded as novelties in spite of economic operation. This reflects the unwillingness of many corporate and municipal bodies to investigate biomass energy and recycling more seriously.

Larger scale adoption of this means of energy would involve several consequences. Large areas of woodland may come into more demand, and the pulp and paper industries may suffer. In a similar vein, such processes as production of "gasohol" from crops may eat into food supplies. Utilization of waste materials may involve a larger waste management system which incorporates recovery of mineral resources.

Special cultivation may provide the ongoing reserves of trees and plants necessary.

Almost unique in the world and certainly unique in terms of scale, is the resource offered by tides in the Bay of Fundy. Large-scale development of this resource would involve huge financial resources, and the construction impacts on adjacent land would be immense, notably in the demand for fill and aggregate. Environmental impacts of a tidal barrage are unknown but will be significant particularly in terms of sedimentation. In locations where causeways have been built astride Fundy tides (as at Windsor, Nova Scotia and Moncton, New Brunswick) extensive mudflats have developed downstream from the structures and it has been argued that mudflats would dissipate the very energy a barrage was designed to extract before it reached the barrage. Also unpredictable are the effects of such a barrage on the overall tidal system in the Bay of Fundy and Gulf of Maine. If a barrage is built it would generate electricity far in excess of the needs of the Maritime Provinces so other markets must be found. The scale of financing required is beyond the underwriting capability of most existing institutions.

Energy Resources — A Summary

In energy resource development are many of the themes which underlie resource use. As relative prices increase more remote and less economic supplies are pulled into the orbit of technological and economic possibility. The use of "new" resources may spur invention and innovation and may give previously underprivileged areas a new hope for economic self-sufficiency. Energy perhaps exemplifies this process better than most others because of necessities such as warmth and light. There is an immense range of sizes of energy innovation, from James Bay or the Bay of Fundy to the individual household powered by a bank of solar cells. Rarely have individuals in any society in history been faced with such a range of options.

As markets have changed under the influence of OPEC so the excitement in countries with energy reserves has risen. In Alberta the oil-sands and heavy oil reserves are now almost economically recoverable. The challenge of frontier development is being faced both in Arctic areas and beneath the Atlantic Ocean. It is ironic that such a universally condemned price-fixing cartel as OPEC is responsible for the present energy boom in Alberta, for much of the present activity by oil companies and governments around the world and for new hope in areas like Atlantic Canada. This process, however, must take time, and net imports of oil into Canada of 215,000 barrels per day cannot be replaced overnight although conversation efforts could reduce this figure.

The corporate control over Canadian energy resources is particularly disturbing to many people; 17 of the top 25 petroleum companies in Canada are more than 50 percent owned outside Canada and these 17 companies account for 72 percent of all Canadian oil and gas sales. The management of energy resources is much more difficult when the majority of shareholders does not live in the country where the resource occurs. The response of newly oil-rich nations, such as Norway, Britain and Mexico has been to exercise significant state control over oil reserves. Canada has come forward with Petro-Canada to fulfill an equivalent role in resource development and management.

The environmental effects of energy use have tended to be shuffled aside in the search for newer and better reserves at home. Experience has shown that the use of gasoline and coal in particular can add significantly to airborne pollution and have very strong negative effects on environmental and personal health. The willingness to combat these trends is in part a function of the availability and expense of necessary technology and in part a function of corporate and governmental responsibility. Once again the importance of a measure of control becomes evident to impose management strategies.

The unique importance of energy resources in modern Canadian society is well-known. The country possesses a wide variety of reserves of almost all types of energy. The wise development and use of these resources will, perhaps more than any other resource-based issue, test the strength of the Canadian character.

6

Mineral Resources

The production of most of the large array of items available to Canadians requires a large variety of mineral resources. Canadian reserves of most of these minerals are impressive.

There are broadly three groups of mineral resources, ferrous, non-ferrous and industrial. Ferrous minerals, or iron, are part of the foundations of a modern industrial society; non-ferrous minerals include such essentials as aluminum, lead, nickel and zinc as well as gold and silver; and industrial minerals include asbestos, gypsum, sulphur, salt and structural minerals like cement. In the production of some of these minerals, such as nickel and asbestos, Canada leads the world.

Ferrous Mineral Reserves

Iron began to displace bronze as the major metal for tools and weapons at an early age. Bronze required the combination of two minerals, tin and copper, whereas iron required the smelting of a single ore. It was many centuries however before iron smelting became an easy process. Although men were familiar with the metal from the earliest times (as well as with the production of steel from iron by prolonged heating in charcoal in an airtight container) it took the invention of the blast-furnace in Europe before the true age of iron began. Even then the energy demands of a blast-furnace before the use of coke (made from coal) were largely met by wood (charcoal) and the prolonged sustained heat needed by the iron-smelting process severely limited the expansion of this new technology. Abraham Darby in 1709 was the first to use coke successfully to smelt iron and this date remains one of importance to the Industrial Revolution.

Smelting began in Canada in 1736 on the St. Maurice River above Trois-Rivieres, and a blast-furnace was built at Lyndhurst in Ontario in 1800. Competition from British and American iron and steel held the Canadian industry back as did small and widely separated markets. By 1879 when a tariff was imposed on imports and a bounty offered on domestic iron, only a single smelter of importance was operating, at Londonderry, Nova Scotia. As these protective measures began to take effect so the centre of the industry began to settle around the western end of Lake Ontario with Hamilton as the major town. Other smaller centres grew up at Sault-Ste. Marie (based on an iron ore deposit at Michipecoten, Ontario) and in Cape Breton, Nova Scotia (based on local supplies of coking coal and ore reserves on Bell Island, Newfoundland).

From these beginnings the production of iron ore expanded to almost 52 million tonnes in 1977 from a total of 15 mines in Labrador, Quebec, Ontario and British Columbia. Major developments in recent years have been in Labrador and Quebec along a geological feature known as the Labrador Geosyncline. Mines presently operate at Schefferville, Labrador City and Wabush. There are enormous deposits of high grade ore (50-60 percent iron) which can be mined in open pits and even larger deposits of lower grade ores. First concessions for exploration were granted in 1942 to companies mainly interested in gold. By 1945 at least 300 million tonnes of high grade iron ore had been identified. At that time the Mesabi iron ores of northern Minnesota were thought to be declining and a voracious post-war iron and steel industry in the United States was casting around for alternative supplies. In spite of the remoteness of the deposits the size and quality of the ore justified building a loading terminal at Sept-Iles on the St. Lawrence, 350 miles of railway to the proposed mines at Schefferville, and a new town to house workers at Schefferville.

As more deposits have been identified so more towns have been laid out (Labrador City and Gagnon) and treatment plants have been built to reduce the bulk of the ore before it is shipped to Sept-Iles. These plants and towns have necessitated the construction of hydro facilities and complete social, commercial and recreational facilities. In no other area of northern Canada has resource development justified construction on such a scale.

Much of the iron ore is exported to Europe and the United States. With the slowdown of the world economy in the 1970s people have been buying fewer consumer items which require iron and steel in their manufacture, so the impact has been felt in these communities. In fact, the Lac Jeannine mine near Gagnon which exploited a lower grade ore in 1961 closed in 1977 although the processing plant continues to be fed from another mine 64 km away at Fire Lake.

Iron and steel production is sensitive to the various impurities found in iron ores and blast-furnace operations are designed to use a specific grade or type of ore. This explains in part why Hamilton still relies on American ores for a significant part of its steel production, although major supplies now come from Quebec. The older blast furnaces in Sydney, Nova Scotia are fed still, in part, from Brazil. World trade and transportation in iron ore is therefore complex. Except for energy in its various forms iron ore is by far the largest mineral commodity carried on the world's oceans and the success of a mine can rely to a large extent on transportation costs. In 1976, Hamilton could obtain supplies shipped from Marquette mines in northern Michigan more cheaply than from Quebec-Labrador mines. Canadian ores must also compete in world markets with other suppliers such as Brazil and Australia. Quebec-Labrador ores could not compete easily in the lucrative Japanese market with the ores from Australia mainly because of the extra distance involved.

Canadian iron ore reserves are, however, immense and are found in places as diverse as Bell Island, Newfoundland and northern Baffin Island. World reserves are correspondingly immense and costs of production and transportation are likely to play a major part in deciding whether deposits are developed. It is likely that the major deposits along the 500 miles or so of the Labrador Geosyncline, which include high quality ores, will dominate Canadian production for many years along with slightly more accessible deposits in western Ontario. The role of many of these reserves in opening up frontier areas needs emphasis.

Non-Ferrous Mineral Reserves

Major minerals in this category are copper, nickel, lead, zinc, molybdenum, silver and gold. These seven metals accounted for about 65 percent of total annual metal production in Canada in 1979, or about $5.2 billion. Reserves are large and new discoveries are constantly being made. All these metals are important in a variety of industrial processes and gold and silver have unique roles to play in the operation of the world economy.

Copper reserves are mainly found in Ontario and British Columbia. The metal is extremely malleable and has long been manufactured into tools and implements. When alloyed with tin it produces bronze, and it is valued because it does not corrode easily, it conducts heat and electricity well and is plastic over a wide range of temperatures.

Demand and production for copper was relatively small until after 1800. Michael Faraday's electrical discoveries in the 1830s changed this and the rapid growth of the electrical industry in the second half of the nineteenth century sparked the search for new reserves. The Bruce Mine in the Algoma District began production in 1847 and the copper-nickel discoveries around Sudbury came in the 1880s. Mines in Newfoundland, British Columbia and Manitoba followed.

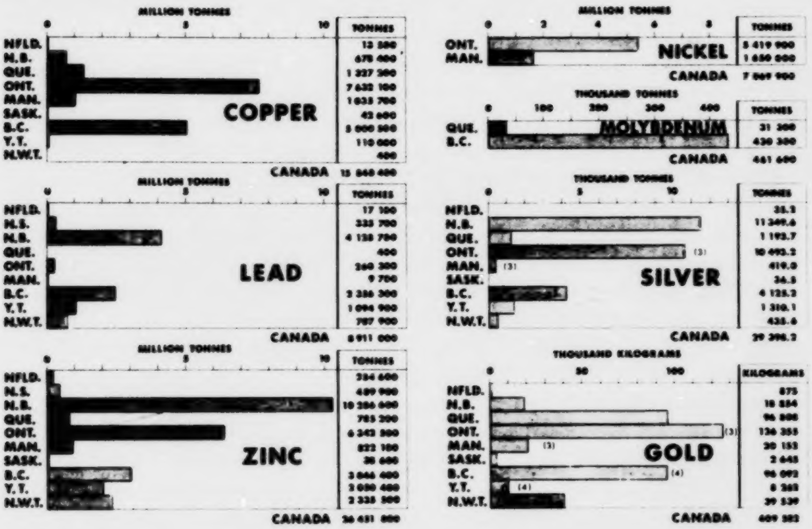
Nickel is associated with copper in ores at Sudbury, Ontario and makes up the exclusive output of the mine at Thompson, Manitoba. For many years (until a Swedish scientist isolated nickel in 1751) it was thought to be an extremely hard form of copper. After the Sudbury deposits were discovered a drive took place to find an economical way to separate the nickel and exploit its hardness. Nickel alloys have since become widely used.

Development of deposits around Thompson came in the 1950s and involved the construction of a town, a railspur from the Hudson Bay Rail Road and the western world's first fully integrated nickel mine

Figure 6-1

CANADIAN RESERVES OF
COPPER, NICKEL, LEAD, ZINC, MOLYBDENUM, SILVER AND GOLD
IN PRODUCING MINES AND DEPOSITS COMMITTED FOR PRODUCTION (1)
MEASURED AND INDICATED RESERVES OF METAL CONTAINED IN MINEABLE ORE (2)
as of JANUARY 1, 1979

NOTE: 1 TONNE = 1.102311311 short tons



(1) Includes a few mines that are not in operation but are included in company ore reserves
(2) No allowance is made for losses in milling, smelting and refining
(3) Estimated Manitoba silver and gold reserves of Inco Metals Company are included in the Ontario totals
(4) Gold reserves in placer deposits could not be estimated

and processing plant. The Kelsey Power plant at the Nelson River, 53 miles from Thompson, was built to provide power to this plant.

Lead and zinc often occur in association, along with silver ores. Lead is soft, malleable, resists corrosion and has been much used in batteries and as an additive to gasoline. Lead compounds such as red lead or white lead are used in paints. Zinc is the most widely used non-ferrous metal other than copper and aluminum. When alloyed with copper it forms brass and this is a major use. Zinc plating as a protective coat for steel is even more important. Major reserves of both lead and zinc occur in northern New Brunswick with zinc also occurring in Ontario, British Columbia and northern areas. Communities associated with mining one, other, or both metals are Kimberley, British Columbia; Pine Point, Northwest Territories; Porcupine – Timmins, Ontario; Metagami, Quebec; and Bathurst, New Brunswick.

Canadian production of molybdenum comes mainly from Endako and Peachland in British Columbia. Production of this metal, used mainly in molybdenum-bearing steel for oil and gas pipelines and casing in oil and gas wells, has occurred largely in Canada since 1960. Most output is exported. There is a particular premium on this light, strong metal as the 1980s begin because of the energy situation as more and more deep wells are being drilled and more pipelines are being constructed. It is also increasingly being used to save weight in automobiles.

Silver and gold are special. Silver compounds have an appreciable industrial use in the production of photographic film while gold is mainly used for such things as plating and jewelry. Both are precious metals and are held in high regard as stores of value and hedges against inflation. The value of monetary reserves have for centuries been based on silver and gold. The search for these metals has spurred men to sell everything they possess to finance a grubstake to join various "rushes".

The price of gold was for long fixed at $35 per ounce but this price was abandoned in 1971 and sale was allowed on open markets. In the beginning free market trading in gold was quite restricted and remained unexciting. A price increase began in 1972 which fairly accurately reflects uncertainty of the effects of oil prices on the world economy. This early rise in gold prices peaked at the end of 1974 at more than $180 per ounce. A second and even more dramatic increasing trend began in mid-1976 which peaked in early 1980 at more than $800 per ounce and which reflected further uncertainties surrounding political events in Iran and Afghanistan. Gold is the ultimate inflation-proof store of wealth for many people and governments and is a reliable barometer of global uncertainty. Price increases such as these (to a lesser extent the same had happened to silver prices) have had important effects on Canadian production of these precious metals of which Canadian production is third in the world. A flurry of exploration has occurred in the areas of ancient rocks known to contain gold and silver ores. Mines long abandoned because of quality of deposit or difficulty of extraction have been re-opened. Former gold producing areas, such as those in Nova Scotia, have been re-examined and a start made on new extraction facilities.

The position of gold as part of the official monetary reserves of many countries was phased out in 1978 but many countries still count their reserves as part of their wealth. This will continue to have a strong influence on the price of gold as will more recent trends of purchase by individuals as a hedge against inflation. As long as there is uncertainty in the world, whether economic or political, demand for gold and silver will remain strong.

Other metallic minerals produced in Canada include cadmium, cobalt, tungsten and, as seen earlier, uranium. Relative to the seven mentioned and iron ore these minerals are, however, relatively unimportant. This may change as world political and economic circumstances change; for example any prolonged slowdown of chromium production in Zimbabwe could bring new importance to chromite reserves in Manitoba and Quebec, or any increase in world tensions could increase demand for so-called strategic minerals such as tungsten, which is used in armour plating.

Industrial and Structural Mineral Resources

Although much less glamorous than metallic minerals these minerals are equally important in their own way. Industrial materials such as asbestos, potash and salt are valuable in construction, industry and agriculture and structural materials such as cement, sand and gravel, and stone are essential to the construction industry.

Canadian asbestos production is second only to that of the Soviet Union and accounts for the bulk of the world's trade in that mineral. Major production is from Quebec's Eastern Townships with production valued at $431 million in 1977. There is smaller production from deposits in British Columbia, Yukon and Newfoundland. Asbestos is a fibrous mineral and use tends to depend on length of fibre. Longer fibres are used primarily in the textile industry as electrical insulation and as filters. Medium length fibres are used as reinforcing fillers in asbestos-cement products and as friction materials such as brake linings and clutch facings in the automotive industry. Short fibres are used primarily as reinforcing fillers in plastics, floor tile, asphalt, and in paints.

At the end of the 1970s asbestos became the centre of controversy as a cancer-causing agent. There have been numerous examples of asbestos fibres in the air of public buildings such as schools and offices in Canada where asbestos has been used in construction; the buildings usually have been closed temporarily for inspection and in Nova Scotia all schools have been inspected for this possible health hazard. In the United States asbestos has been classified officially as a "category 1" known carcinogen and rules have been implemented to impose severe restrictions on the amount of human exposure. Canada has also established health standards. The mineral is important in a wide variety of uses and is unlikely to be banned as an industrial material. Research is well advanced, however, to produce substitute fibres and those fibres will probably be more acceptable because of reduced health hazards. Overall demand for asbestos will follow quite closely the fortunes of the construction industry.

Major potash production comes from Saskatchewan although an extraction facility is presently [1982] under construction in southern New Brunswick. Canada exports most of its production and accounts for 38 percent of world trade. The bulk of production is in the form of potassium chloride and is widely in demand as an agricultural fertilizer.

Salt deposits are widespread in Canada mostly as bedded or dome-type structures under the earth. It can be extracted by conventional mining operations or by pumping down steam under pressure to the salt deposit and forcing brine to the surface, which is then evaporated to obtain salt crystals. Major production comes from Ontario and Nova Scotia accounting for $75 million of production in 1977 out of a total of $90 million nationwide. There is a secondary production as a by-product of potash-solution mining in Saskatchewan.

Sulphur is an important industrial raw material obtained from several sources in Canada. Elemental sulphur is obtained from "sour natural gas", or that containing a high proportion of hydrogen sulphide (H_2S), or from hydrocarbon sources. This second source is particularly important where it is part of recovery from smelter gas, because if not intercepted and extracted it combines with atmospheric moisture to form acid precipitation. Many gas, oil and coal reserves in Canada have an unacceptably high sulphur content by this standard. Sulphur can also be obtained from pyrite and pyrrhotite concentrates produced as a by-product of base metal production. Sulphur is used in the production of sulphuric acid and for fertilizers.

Cement is fundamental to our industrial economy in a literal sense and is produced by burning a mixture of finely ground limestone, silicon, alumina and iron oxide. The product of this process is then mixed with gypsum and reground to form the fine powder known as Portland cement. When combined with water, sand, gravel, crushed stone or other aggregates it acts as a binder to form concrete. Total Canadian production of cement was valued at $409 million in 1977, mostly in urbanized and urbanizing provinces such as Ontario, Quebec, Alberta and British Columbia which together accounted for $336 million of this total. The fortunes of the cement industry are heavily reliant on swings in construction which in turn are closely linked to overall economic activity. Export markets are limited because the materials used occur widely and abundantly and the bulky finished produce cannot bear high transportation costs.

Sand, gravel and stone also are widely used as part of construction activities either to provide fill or in materials such as concrete. Production of sand and gravel is closely related once again to urbanization. Because these are high bulk, low value materials they cannot bear particularly high transportation costs relative to their actual value.

Environmental Consequences of Mineral Extraction

The two major stages when environmental concerns are a serious part of mineral resource development are during extraction of the mineral ore from the earth and refining the ore to a purer form.

In the first of these, extraction, the effect can vary widely. An underground mine has little effect on the surface although tailing ponds can be a problem to local water quality. A relatively low value ore, however, such as iron ore demands extraction by the least costly method. This has in recent years involved stripping away the overburden of materials (soils and sub-soils) to expose the ore body and using large mechanical shovels to extract the ore in huge pits. In the case of nickel and copper extraction in Sudbury, Ontario these methods have left an almost lunar landscape. Equally large holes are being excavated in the Labrador-Quebec iron areas. Sand and gravel pits are particularly troublesome (if smaller in scale) because they usually occur in settled areas and disrupt agricultural activities and the hydrological cycle.

Concentrations of metals in ore, particularly high value metals, can be very low. In the case of gold it is measured in terms of grammes per tonne of ore and the particularly rich Red Lake deposits in Ontario have been assayed at about 25 grammes/tonne. Copper ores extracted at Copper Cliff are considered rich in metal at about 3.5 percent concentrations. It is evident therefore that much of the bulk of the extracted ore should be reduced before shipment over any distance to the point of next use. Smelting is a major adjunct to mining in Canada and can contribute alarmingly to air pollution as impurities are separated as by-products. The Sudbury copper and nickel smelting facilities are often quoted as the single major source of sulphur oxides entering the air, accounting for as much as 10 percent of North American acid rain.

Resolution of this problem will be expensive and in the end consumers must pay for clean-up technology installed in smelters by companies. The longer term price to be paid for not doing this can only be counted in terms of "dead" lakes and no fishing.

Minerals: Non-Renewable Resources

Unlike water, trees or fish, minerals cannot be renewed as they are used up in the process of being turned into economic commodities. The rate of extraction, however, can be altered and reserves thereby conserved but the ramifications of such a course of action could be considerable. The rate of extraction is presently dictated by economic signals; if the automobile factories in southern Ontario sell fewer and smaller cars the demand for steel from Hamilton's mills is less and the community of Sept-Iles encounters rising unemployment because less iron ore is processed and shipped. These lay-offs can be avoided if alternate markets can be found for the ore which would normally be sold to the Hamilton mills but Canada's place in the global marketplace usually means the national economy is merely following international trends.

Physical depletion of a mineral resource (referring to the *volume* of an ore body) usually takes second place to economic depletion and as soon as lower-grade, more difficult deposits are encountered extraction will cease. Over time the changes in markets may change this situation as may technological improvements in mining, processing and refining. Recycling offers a further option in extending the life of mineral reserves. Problems with this course arise in separating all the different components from society's throw-outs in an economical manner. The technology, however, may be less of a problem than is the will to incur large capital costs to build integrated municipal recycling centres to implement such re-use or recovery of resources.

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Forestry Resources

With the exception of the extreme north Canada is rich in forest resources. Much of the Canadian landscape is evoked in terms of maple woods and endless areas of evergreens. With fish and furs the woodland resources gave impetus to the first resource exploitation by Europeans in Canada.

Forests can perform several roles. They can be:

(a) economic reservoirs of fibre for pulp, paper and cellulose, or for lumber;
(b) ecological reservoirs wherein natural ecosystems and wildlife habitat are conserved;
(c) "aesthetic" reservoirs to provide a more pleasant environment in heavily urbanized areas for the psychological welfare of the population;
(d) agricultural reservoirs to protect agricultural land from elements generally detrimental to animal and crop husbandry;
(e) recreational reservoirs for outdoor recreational activities such as hiking, orienteering, natural history pastimes and hunting.

The management of forests to satisfy these widely varying demands presents a major challenge. A forest, once clear cut, is of little use for recreational or hydrologic purposes and is bound to undergo drastic ecological change. To deny industry access to a valuable resource would cut deeply into Canada's gross national product.

In fact, management of forest resources in Canada has few bright spots. A renewable resource has been equated to a limitless resource and in the more accessible areas harvesting of trees has exceeded rates of regrowth. Conscious replanting after cutting is the exception rather than the rule in much of Canada. Disease and insect infestation have been continuous problems for many decades. There have been extensive erosion problems and habitat modification due to modern methods of clear-cutting.

The extent of the resource and its contribution to the economy are impressive. An inventory in 1973 counted more than 3.2 million km^2 containing more than 19 million m^3 of wood. The vast majority of the forests are under the control of the Provinces as Crown land. A further substantial portion is federal Crown land while very little is privately owned. About 65 percent of the total volume of reserves is softwood with major reserves in British Columbia, Quebec and Ontario. Export value of pulp and newsprint in 1976 exceeded $4 billion and with other wood products, such as lumber and veneers, accounted for one-sixth of total exports from Canada.

Types and Distribution of the Resource

Seventy-five percent of Canada's productive forest resources are in the boreal forest which stretches in a broad belt from the Atlantic westwards then north-westwards to Alaska. Coniferous trees, particularly spruce, balsam, fir and pine, predominate. To the south of this belt in the east are the Great Lakes-St. Lawrence and Acadian forests of mixed species such as white and red pine, eastern hemlock, spruce, eastern white cedar, fir, yellow birch, maple, oak and basswood.

Quite different in character are the forests of the British Columbia coastal region. A milder more humid climate with heavy rainfall means trees can grow much larger, with heights of 60m and diameters at breast-height of more than 2m. Thus an area of less than 2 percent of the national reserve supplies almost one-quarter of the wood cut. Major species are western red cedar, hemlock, spruce, fir and Douglas fir.

The final major forest area is the mountainous region of interior British Columbia and Alberta. A wide range of species is represented because climate ranges from very humid to quite arid. Production from this area is expanding rapidly.

South of the boreal zone in Alberta, Saskatchewan and Manitoba agriculture takes over as the major land-based activity and woods in these areas are often far-flung and act more as shelter-belts than resources of timber. In extreme southwestern Ontario, also an area of much agricultural activity, is Canada's only true hardwood forest region but little remains of the original forests. Between the boreal region and the Arctic Tundra, which is essentially treeless, is an area equal in size to the boreal forest which comprises a wide transition zone to the Tundra. Trees are scattered and grow very slowly.

The Economics of Forestry Resources

A classic story of development surrounds the exploitation of Canada's forestry reserves involving an interplay of both politics and economics. Interest, as usual, came first from western Europe. Fishermen took home tales of limitless woods and large rivers. During the 17th and 18th centuries trees in the east were cut mainly for masts and square timber to supply the British navy. The expansion of the British navy at this time was largely contingent on a non-stop series of wars with France and also coincided broadly with the onset of the agricultural revolution and clearing of much land in Britain for farming. The white pine of the accessible forests in Nova Scotia, New Brunswick and Quebec grew to impressive heights and was part of a "climax forest" or the relatively undisturbed product of many centuries of climatic influence and natural selection. These forests also sheltered the animals which fed the fur trade.

The extent of such a resource was beyond the belief of the original explorers and settlers. Some of the wood was cleared to prepare the land for cultivation or to provide lumber for houses, barns and other buildings. Most was shipped across the Atlantic. The hardwoods characteristic of the lower portions of inner valleys were quite rapidly cleared because this land was usually the best and more suitable for settlement and cultivation. Such events as the blockade of Britain by the French navy in the Napoleonic Wars (1798-1815) cut off traditional supplies of wood from Scandinavia and gave a significant boost to operations in Canada.

Modern growth of forest industries began after the 1920s. Until then the major demand had been for lumber in its various forms. Thereafter pulp and paper became dominant parallelling the increase in literacy, education and information demand of western society. To 1960 there was quite a clean split between forestry industries in eastern and western Canada. In the east pulp and paper tended to dominate supplying not only domestic demands but also major markets in Europe and the eastern United States, while lumber was more a product from British Columbia and was more suited to the size of trees in the west. Since 1960 however, the centres of major economic activity have become much more widely dispersed in North America away from the old bases in the eastern provinces and states. In addition the countries circling the Pacific Ocean have become major economic and commercial forces and demands for all varieties of wood products have increased vastly. Large modern integrated pulp mills have sprung up in British Columbia.

There are 300,000 jobs directly dependent on the forest industry, and a further 400,000 to 600,000 in closely related industries. Forest products processing is the most important manufacturing industry in British Columbia, Quebec and the Atlantic Provinces, second in the Prairie Provinces and fourth in heavily industrialized Ontario.

Management of Forest Resources

Such a major contributor to the Canadian economy obviously deserves quite close management but in the past much appears to have been left to chance and time. There are particular problems in economic and financial management. Trees in Canada tend to grow slowly, often taking at least 70 years to regenerate naturally in the eastern provinces. This is a long time in the management spans of financiers. Investments are more commonly designed to repay the capital costs and interest charges over a 10, 15 or 20 year period. This criterion of financial management is a major argument against forest management on a strictly economic basis. Even if advanced and enlightened management methods are employed the length and severity of the Canadian winter puts absolute and definite limits on the rate of tree growth, even in plantations. Plantations themselves are one step removed from the natural selection process which ensures the survival of the trees which are more resistant to disease and also ensures more diversity over a given area. The plantations are thus more prone to devastating infestation. Forest fires are unforeseeable hazards to any investment, particularly during summer, the time of higher recreation use.

There is frequently a direct conflict between economic management of forest resources and ecology. Trees stabilize soils, regulate water runoff and provide shelter for many communities of living things. Disturbance of forests may seriously endanger these functions and cause severe problems of erosion and increase stream discharge during high rainfall. Management responsibilities make the problems more complex. Provinces have responsibilities to manage most forests within their jurisdiction while the federal government has responsibility for such things as water management which is, however, heavily dependent on good forest management.

Enforcement of environmentally-conscious management regulations is very difficult in view of the many areas of Canada in which forestry-related jobs predominate. Forestry products in New Brunswick account for about 60 cents out of every dollar of provincial exports and in such a situation spraying against spruce budworm takes on important socio-economic characteristics. The effects of traditional chemical sprays, when broadcast from the air, on human health and wildlife generate much controversy and emotion. Spraying in New Brunswick has been carried out since 1953 and extensive spray programmes have taken place in Quebec and, since 1977, in Newfoundland. There is hope that chemicals can be effectively replaced by biological methods using parasites, predators or so-called sex attractants which inhibit reproductive performance.

These methods are mostly cures rather than prevention. The 28-year programme in New Brunswick has no more than held the line against budworms. A climax forest is one where the most hardy and resistant species are found in diverse association. The spruce and fir successional forests of the eastern provinces are little more than a stage on the way to a climax. They are excellent food supplies and breeding grounds for creatures like the spruce budworm because of the large areas of uniform species. Where this ecological fact, however, coincides and conflicts with economic realities problems are bound to occur.

It is all too easy to be negative about forest management in Canada, particularly in view of the clash between economics and ecology. There are, however, bright spots. Forest researchers are isolating new

Figure 7-1

Area of moderate to severe defoliation caused by spruce budworm

Province	1975	1976	1977	1978
		(millions of ha)		
Ontario	13.3	14.7	14.1	15.2
Quebec	35.0	33.2	21.4	19.5
New Brunswick	3.5	0.9	0.5	0.7
Nova Scotia	0.9	1.0	0.8	0.6
Prince Edward Island	0.2	0.2	0.1	0.1
Newfoundland	0.7	1.2	1.5	1.3
Total	53.6	51.2	38.4	37.4

Source: Canadian Forestry Service, Environment Canada. 1979. Miscellaneous unpublished data. Quoted in *Canada's special resource lands*, Environment Canada, Lands Directorate, Map Folio No. 4, 1979, p. 182.

genetic species which are more resistant to disease or insect infestation. There are large reserves of wood in the control of smaller woodlot owners and better prices may stimulate more cutting from these reserves. Better prices also should do much to encourage the growth of trees as a "crop" to be tended and harvested much the same as any other crop which is farmed. The importance of woods and forests as life-giving, life sheltering places in the hydrologic cycle and as recreational areas should be management goals as worthy as their role in the economic life of the country.

Wildlife Resources

8

Most of Canada was first explored by Europeans involved in the fur trade. In spite of the inroads which settlement, agriculture and urbanization have made into the native habitats of many animals, the country is so large that an important trade and variety of lifestyles are still based on wild animals. The fur trade, however, is only one aspect. Hunters, naturalists, scientists, conservationists and farmers all value wildlife for a variety of reasons and the sensitivity of animal populations to environmental degradation make them important indicators of the health of air, water and land. In some more remote communities, particularly of native peoples, there is still a heavy reliance on the seasonal movement of birds and animals. Trapping and fishing rights have become major issues in the development of northern energy resources and in the means of getting these resources to more southerly markets.

Economics of Wildlife Resources

Events surrounding the earlier days of the fur trade in Canada are well-known. The first trading posts were established in eastern Canada in the early seventeenth century. The exploits of the coureurs-de-bois and voyageurs in getting furs to market over a maze of water-ways is an important part of Canadian culture and economic history. The Hudson's Bay Company held virtually all of the present day territory of Canada outside southern Ontario, southern Quebec and the Atlantic Provinces as a corporate fiefdom, mostly for the trapping and trading of animal pelts, until 1870.

The fur trade (from wild as opposed to "farmed" animals) was worth almost $50 million in the 1976-77 fur season. Much of the intermediate and final fabrication of furs occurs outside Canada. Major species are muskrat, fox, beaver, coyote, seals, lynx, marten and mink. Major trading partners are Britain and the United States.

Information such as this disguises many things. There is little account here of the value of recreational hunting all over Canada, in terms of demand for hunting equipment, accommodation, food and many other things. The hunt, particularly in the fall and winter months, is an important part of the Canadian psyche and annual holidays are often planned in part around the start of the season. Also, over large areas of the country trapping forms part of an annual cycle which may include one or more of farming, fishing and forestry as other activities defined by season. In the Canadian winter when many other outdoor occupations are not possible the trap-lines are set. The demands of naturalists, photographers and scientists contribute to the effort put behind wildlife management. Economics and trade, therefore, severely underestimate the importance of such a resource.

Management of Wildlife Resources

There is no simple way to summarize the rationale behind wildlife management particularly since the emergence of a conserver society which has put new and often conflicting demands on wildlife resources. Traditional management has been for trapping and hunting, yet even this in the 1980s provokes controversy in the case of, for example, native rights, environmental deterioration and frontier development. In specific and recurring cases there is much emotion. The annual seal hunt in Newfoundland involves clubbing young seals and sensitivities are naturally aroused. The fact remains, however, that seals are an abundant resource still much in demand for fashion purposes, and several small communities would face virtual extinction if the practice was stopped.

Protection of animals less adaptable than man is part of government policy. This is mainly due to the insistence of groups such as conservationists and native peoples. In the northern areas, Canada's last land frontier, the fragile and inter-locked nature of plant and animal systems in harsh climates poses crucial problems. Energy reserves are being explored and some will be developed and the products must reach markets. The deliberations of the MacKenzie Valley Pipeline Enquiry gave seemingly disproportionate consideration to protection of the Porcupine Caribou herd in the delta of the rivers. In fact, this enquiry may stand as one of the first in Canada in which large capital projects such as pipelines are deemed, in effect, not to be worthwhile if they disrupt a natural system and the society which has evolved around that system. For once a resource which is in demand to an extent which requires immediate development in the eyes of managers and consumers far away may only be extracted and transported to market at a cost which more accurately reflects the true costs of exploitation. Economic and financial costs form only part of this cost and consideration of wildlife puts the true nature of the resource into more perspective.

Themes in Resource Development and Use 9

Resources and Economic Growth

Attempts have been made throughout this text to show how relative prices determine the rates of development and exploitation of natural resources. As the price of oil in the Middle East increases, it becomes economical to develop and transport frontier oils in Canada. As the price of gold increases formerly uneconomic long-abandoned mines in Nova Scotia are re-appraised. As the demand for automobiles declines because of the higher price of energy and/or lower real incomes the rate of extraction of iron ores in Quebec and Labrador slows down. The human dimensions of these changes are often dramatic involving either job creation or lay-offs, skill training and the movement of people from area to area.

The economics of these shifts of emphasis have long been recognized. The first detailed explanation was due largely to the efforts of three British economists who lived in the 18th and 19th centuries. They were Adam Smith, David Ricardo and Thomas Malthus. Ricardo in particular identified how population growth put pressures on existing resources and brought new resources into play. His famous example involved the different qualities of agricultural land. At a certain level of demand (the interplay of population and income) sufficient food could be grown and reared on the best quality land and other inferior quality land was not cultivated. As population increases, or as incomes increase and therefore demand increases, so will the amount of inferior land cultivated. Returns from the inferior land will be lower but its use will still be worthwhile to raise food. In economic terms the better quality land has a higher economic rent than the lower quality land.

Ricardo's "Principles of Political Economy and Taxation" was published in 1817. Adam Smith's "An Inquiry into the Nature and Causes of the Wealth of Nations" had been published earlier, in 1776. Smith is the father of modern economic thought and in this classic work he defined different stages of economic growth (from "rude" hunters to nomadic agriculture, to feudal agriculture and commercial interdependence) and the institutions associated with each stage. In the commercial interdependence stage in particular he introduced the concept of the "invisible hand" of the market as a self-correcting mechanism.

Ricardo elaborated and organized Smith's ideas in his theory of comparative costs. Ricardo also held that the economic growth as defined by Smith must sooner or later slow down as natural resources run out. Thomas Malthus gained lasting notoriety on this theme after publication of his book "Essay on Population" in 1798. His well-known central theory is that population increases at an increasing rate (or geometrically) whereas food supply increases at a constant rate (or arithmetically). Population therefore must outgrow the ability of the world to feed all the people. Malthus invoked the spectres of war, famine, vice and pestilence to correct this situation. His theory can easily be extended to all natural resources and it is largely due to Malthus that economics is known as the dismal science.

It must be remembered that the contributions of these three remarkable men were committed to paper before the first capital-intensive industrial society emerged. Affordable technological innovation and consequent increases in productivity, put more resources at the disposal of men than anyone thought possible. Ricardo's ideas of comparative costs and economic rent, however, have stood the test of time very well. The post-war world, too, has seen a resurgence of Malthus' ideas as the era of "limits" has been explored. Resources are recognized as finite in respect of population they must satisfy all over the world. And the idea of Smith's invisible hand although much altered by government and political ideologists still provides the basis of many of the world's workings.

The Stages of Economic Growth

The modern stages of economic growth have been defined by Walter Rostow who in 1960 identified five major phases.

(a) The "traditional society" has very limited production and "pre-Newtonian" science and technology. In these societies a high proportion of human effort is devoted to food production with little or none left over for other economic pursuits.

(b) The "preconditions for take-off" is a period of transition during which the traditional society begins to explore science and by using science increases the productivity of resource exploitation. Resources are made to last longer and stretch further. Western Europe in the late 17th and early 18th centuries was the first society to enter this stage and scientific discoveries and the beginning of trade and colonization typified the era. A variety of resources began to take on more importance.

(c) "Take-off" is crucial and involves the breaking down of old blocks to progress and rapid technological innovation and adaptation. Resources feed new industries which yield profits sufficient for considerable ploughing back into more new factories. This process of capital formation occurs at a compound rate of interest. Railway construction as a relatively cheap means of transportation was crucial to take-off in countries such as the United States, France, Germany, Canada and Russia.

(d) The "drive to maturity" occurs when modern technology is widespread, older industries level off and newer industries accelerate. This is a period of fluctuating fortunes with a general upward trend in most indicators. Older resources become relatively less important as, for example, the focus switches from coal, iron and heavy engineering to more technologically sophisticated processes like machine tools, chemicals and electrical equipment. National economies become more interdependent.

(e) The "age of high mass consumption" was reached first in the United States. Leading sectors are oriented towards consumer goods and services and the political process allocates increasing resources to social welfare and security. The decisive element identifying this stage is the cheap mass-produced automobile.

To these stages both Rostow and his many commentators have tended to add a sixth stage, the post-industrial society which has been achieved only in North America. Leisure becomes the object of life rather than material possessions and the provision of services, rather than manufacture of goods, is the major industrial pursuit.

In this system of stages Canada occupies a strange situation. The traditional society is simple to identify; it comprises native peoples and their overall dependence on seasonal animal and fish movements, along with primitive agriculture. The preconditions for take-off were developed once and once only in world history, in western Europe. From here they were exported all over the world and, in North America, often improved. Take-off in Canada is closely correlated to completion of the trans-continental railroad in the 1880s which led to the opening up of the western areas and their rich resource base. In the eastern provinces this stage occurred earlier as they were first merged into the global economy then developed their own individual bases. In many parts of Canada it could be argued that this stage has not yet been reached, however, as resource development has not led to a diversified industrial base.

It is interesting that Canada reached the age of high mass consumption (in the 1920s with the introduction of automobiles and their rapid spread) before it reached maturity, a peculiarity Canada shares with Australia, another European-settled, resource-rich country. To a large extent the Canadian economy remains immature, based on the export of raw materials and the import of the manufactured, mass consumption goods. The location of Canada adjacent to the United States explains much of this anomaly along with strong cultural and blood ties to western Europe and relatively easy (and, therefore, cheap) access to the other major manufacturing economy in Japan.

This characteristic of Canadian industry and society is often bemoaned and its ramifications are many. Much of the Canadian resource base has been and is developed using non-Canadian capital. Control of these resources is, therefore removed to varying degrees from Canada. The Canadian economy is heavily dependent on shifts in demand outside Canada and being largely resource-based it is not in a position to be flexible and adapt easily to changes in relative economic fortunes.

The Canadian domestic market is relatively small. This inhibits manufacturing industry in several ways. The ability to generate capital (from savings of individuals for example) is reduced. The "overhead" or "fixed" costs of manufacturing are spread over fewer people and are, therefore higher per person which will usually be reflected in higher product prices. A small and scattered population makes it more difficult to justify building roads, railways or other social facilities.

Ultimately therefore, Canadian resource industries must depend on exports to whatever market is available. Swings in global economic fortunes reverberate back down the system insistently and large parts of Canadian communities are affected. However, the richness and variety of the resource base in Canada gives the country flexibility and stability. The laid-off iron miner from Labrador City can move to other parts of the mining sector where demand for the product remains strong and labour is still required, or to the oilfields of Alberta to learn a new trade. The Newfoundland fisherman can look forward to jobs created around the development of offshore oil deposits. This mobility of people between places and jobs is a luxury not many people in the world can claim and is due to the diverse resource base.

The Resource Town

The vulnerability of a national economy based primarily on resource extraction and export is particularly evident in the case of resource towns. These are communities dependent for their existence and prosperity on a single extractive activity, and they are widespread throughout Canada. These settlements rise and fall with the development and decline of a natural resource. Usually, but not always, they are remote outposts and their population tends to come from a wide geographical background. Some of the towns have existed for many years, others are no more than temporary camps. Most are quite small and many are developed and owned almost entirely by the companies developing the resource. Very few have survived depletion of the resource itself because of the inability to diversify into other industrial or service activities. Those which have survived are usually fairly close to established population centres and communications networks. These towns, however, are still communities and in more recent times, extensive preparation has gone into the planning of housing and social facilities and the overall layout of the community.

Development of Canadian resource towns quite accurately reflects the process of resource development itself. The first major area of such settlements was in the southeastern part of the Canadian Shield to tap rich mineral and forestry resources. This area is quite close to the industrial heartland of Canada, along the St. Lawrence River and the Great Lakes. Since 1945, the resources of northern Canada, more remote and "unknown" have been explored and quantified. The asbestos and coal deposits of northern British Columbia, the nickel ores in northern Manitoba, the heavy oils and oil-sands of northern Alberta and Saskatchewan, and various mineral reserves in Quebec and Labrador have come within the realm of economic exploitation and have given rise to towns such as Schefferville and Labrador City, Thompson and Fort McMurray, Elliott Lake and Chibougamau.

Resource towns are characterized by explosive population growth during their early days with declines that are almost as dramatic Dawson City in the Yukon had 40,000 inhabitants at the height of the Klondike gold rush, today it has less than 1,000. The 1961 census counted 386 people in Labrador City (established in 1960) and the 1971 census counted more than 7,600. The longer lived coal mining communities of Cape Breton have undergone a lengthy and slow decline as coal was replaced by oil as an energy source, or as methods of extraction became more mechanized. Many very small fishing communities in Atlantic Canada live a hand-to-mouth existence and cast uneasy glances at efforts to increase the size and mechanization of vessels.

There is little doubt that giant strides have been made since the era of the company store, but in one important respect the corporations involved in resource exploitation hold enormous sway over the fortunes of many remote communities; they still depend on sustained markets in the global economy for continued operation. During periods of economic slowdown the risk facing the people in these towns is heightened. To this feeling of uneasiness can be added the unpleasant pressures of isolation, particularly where families and children are involved, and despite the best efforts of companies and authorities to provide model educational, health, recreational and cultural facilities. Increasingly, government is involved in the process of resource town establishment, although the initial results of such concern and legislation have been mixed. The Instant Town Act of British Columbia relieved corporations of much of the financial burden of providing housing, schools, roads and so on. It has been argued that this lessened the financial stake of the company in ongoing existence for the community and thereby could hasten its end.

The resource town, therefore, remains a feature of the Canadian landscape and many of the problems remain. Only rarely has the location of a resource town been suitable for the diversification of the industrial base necessary to ensure continued growth. The incidence of communities in decline is still evident across Canada as the resource on which the community was originally based is depleted or world-wide demand declines.

Resources and Nature

Concern about the costs of economic growth is largely a phenomenon of the years since 1960. A previous section outlined the role of resources in economic growth and consideration of the effects of resource exploitation on natural processes and landscapes has been a recurring theme in this account. Put simply, there are costs incurred in mining ores, burning energy and fabricating resources into consumer goods which fall outside the profit and loss statements of corporations or outside the surplus and deficit statistics of governments. People, plants and animals must eventually bear these costs which may occur in the form of persistent air and water pollution, increased incidence of malignant disease, or fewer fish in lakes and rivers.

Precise figures are all but impossible to calculate, mainly because cause and effect are not always clearly defined. As well, human nature seems unwilling to contemplate short-run economic deprivation in exchange for long-run health. The 19th century social philosopher, John Stuart Mill, coined the phrase "economic man" to describe the pursuit of wealth and this pursuit seems to characterize most human history and is a common goal of all ideologies.

While populations were small the problems remained localized and options were easier to find. Primitive Indian farmers worked out one patch of soil and moved on to another. This is no longer possible as world population increases rapidly. The role of the human animal is ambivalent. Firstly, man is an "exploiter" using his superior mental and mechanical powers to further his own lot in life by development of available resources. Secondly, he is a protector as these same mental and mechanical powers can regulate the rate at which exploitation takes place. In this second role man is unique in the natural order of things, with a frightening ability to control his own environment and the environments of all other living things. Application of the types of technological innovation which spurred our present system of social advancement could help to preserve an environment in which future generations might enjoy the fruits of the "ideal world". The installation of scrubbers in smokestacks can reduce emission of sulphur oxides from smelters and thereby reduce the effects of acid rain. Adequate planning can avoid many of the problems of unsightly and destructive open-pit mining. These measures, however, require a financial commitment which, in turn, requires consumers to pay more to cover some of the costs of the wider problem.

To solve the problems which beset a modern industrial society is in itself the major driving force behind that society. In terms of natural resources the problem includes consideration of most of the natural forces which sustain all life.

Concluding Remarks

The President of an emerging African nation remarked in an interview in July 1980, that the natural conditions and resources of his country were "as good as Canada". The compliment emphasizes the rich endowment of natural resources in Canada and how this is regarded around the world. Equally, there are many unresolved problems surrounding development of these resources. The major problems can be summed up quite easily; they are:

(a) **Trade versus manufacture**: Most Canadian resources are exported after only minimal processing in Canada. Major contributions to add value to these resources occurs outside Canada by the application of labour skills and these resources can subsequently be re-imported by Canadian consumers. Solving this problem will be far from simple. Resources account in large part for Canada's healthy trade balance even in times of world economic slowdown. Whether exports of manufactured goods could maintain a hefty trade surplus is doubtful given the relatively high cost of Canadian labour.

(b) Closely linked to the first problem is that of **non-Canadian ownership** of concerns active in resource exploitation. In this respect the country has not completely shaken off the last vestiges of colonialism, when Canada was opened up for its furs and its timber by European capital and demand. Flows of capital resources into and out of Canada are still largely unrestricted, although federal government agencies like the Foreign Investment Review Agency keep a watchful eye on foreign companies wishing to purchase control of Canadian companies. Only slowly is awareness growing that control over investment decisions to develop resources can be made from Canadian boardrooms without really endangering the capital necessary to develop projects. It is likely, however, that the size of projects presently considered must involve some government participation.

(c) **Environmental conservation and management** pose very difficult challenges. There is little doubt that the means of protecting or restoring natural systems and landscapes already exist, but they can be very expensive. In a world

> where inflation runs rings around the best efforts of governments to control it there is much doubt that a mood exists to pay the necessary price. Inflation is largely a phenomenon fired by non-Canadian influences. The interdependence of worldwide economic and political systems means, among other things, that individual countries are reluctant to reduce their competitiveness by incurring "unnecessary" costs. The uncertain benefits of environnental protection fall outside corporate profit and loss statements. That such benefits exist seems certain, and they may only be felt by future generations.

Resources continue to play high-profile roles in the unfolding Canadian drama. In 1982 the issue of control and who benefits from resource exploitation is less one of non-Canadian control than between the provinces and the federal government. The western provinces demand more direct control over benefits from energy reserves, as do Newfoundland and Nova Scotia with regard to potential reserves under the Atlantic Ocean. In this way the current economic realities of Confederation may not coincide with the high ideals of the Fathers of Confederation. The sheer distances involved in a country as large as Canada, with a small, scattered population, aggravate this problem as trade is often more economically sensible with foreign countries than with other parts of Canada.

Although demand within Canada for the commodities which are made from resources is limited by a relatively small population, this demand will be maintained over the long run as world population increases. Basic resources such as food and energy, will continue to be in high demand. World economic and political circumstances will make previously uneconomic resources more attractive, as will advances in science and technology. Behind all this, however, is the underlying truth in economic production; it isn't what you can produce that counts, but what you can sell.

Many more specific problems are equally urgent. The questions of the spread of urban areas onto valuable foodlands, the disruption of native societies by pipeline construction in Arctic areas, the devastation of ill-managed forests by insects, and the numerous and often conflicting demands on a single, finite set of resources, must all be faced. Some small steps have already been taken; Canada now has exclusive management jurisdiction over fish stocks within 200 nautical miles offshore and provinces are slowly facing up to their responsibilities in land-use management and planning.

Behind all this is the undeniable truth of the wealth of resources in Canada. For such a small population the future should be assured for many generations. Wise use of this endowment will represent an ongoing challenge to the Canadian character and the obligations of this country as a member of the global community.

Teachers' Notes

by

Marcia Byers Armstrong

Teacher's Notes

In teaching Canada's resources and their use, the instructor can organize the material in a variety of ways. These can range from a traditional structured approach to the topic outlined in Figure A to an issue oriented approach outlined in Figure B. Each of these has its advantages and disadvantages.

The structured approach organizes the material in a logical progression for both teacher and student and might be more appropriate for the younger audience. However, it can tend to encourage 'tunnel vision' in that examination of relationships and issues between and within regions becomes less likely.

The issue oriented approach would encourage an eclectic appreciation by stressing the dynamic nature of the resource system. Any change or innovation in one field can have direct repercussions in another seemingly unrelated resource area. The major disadvantage to this approach is its apparent lack of an initial base of knowledge on which to develop and discuss the relevant resource related issues. Depending on the maturity of one's students, this type of method, no matter how skilfully presented, could be confusing and potentially detrimental to the student who finds it difficult to assess information and evaluate a wide variety of opinions in order to define his own values on a particular issue.

Of the two outlines described, the issue oriented approach would provide a greater challenge to the teacher primarily because more preparation time would be required. Acquisition of topical teaching aids unavailable in any one textbook – for example, newspaper articles, air photographs, slides, topographic maps, relevant legislation, briefs by various lobby groups, etc. – would take considerable time and money (for maps, slides, and aerial photos). Certainly the use of some or all of these materials could greatly increase a student's opportunity to participate in the learning process.

Regardless of the organizational approach selected by the teacher, it is important to present as many different types of lessons as possible. Using a variety of methods keeps a class alert and more interested in the subject matter. This guide will present several sample lessons and exercises, using a number of techniques and aids, which might be useful in assisting the teacher to prepare a section on Canada's natural resources. In each case, the use of teaching aids, other than the student's textbook, has been encouraged. Teachers should note that the

Figure A

What is a Resource?

The Climate of Canada
- latitudinal, landform, waterbody influences
- climate types and location

The Landforms of Canada
- general introduction
- map exercise locating different regions

  The Western Cordillera
    - rock type and formation
    - agricultural activity - Okanagan Valley or Fraser River Delta
    - lumbering industry
    - role of water power - Kitimat (aluminum smelter)

  The Interior Plains
    - rock type and formation
    - agriculture - the prairie wheat farm - dry farming techniques
    - oil and gas exploration and development

  The Canadian Shield
    - rock type and formation
    - glaciation and its effects
    - pulp and paper industry - Kapuskasing
    - mining industry - Sudbury or Schefferville
    - water power - Arvida (similar to Kitimat - do one or the other)

  The Great Lakes - St. Lawrence Lowlands
    - effects of glaciation
    - agriculture - Niagara Fruit Belt
    - power - nuclear, water

  Maritime Region
    - rock type and formation
    - effects of glaciation
    - fisheries - inshore and deepsea
    - offshore oil and natural gas
    - agriculture - P.E.I. example

procurement of an Atlas of Canada for each student's use in class is essential.

A: Use of the Socratic Method to Develop a Concept

The usefulness of the 'Socratic' or questioning technique in teaching cannot be stressed too much. It is an excellent tool for leading the student successfully from his known accumulation of knowledge to a new, previously unconsidered body of information by using a series of short, guiding questions. It is more time consuming than the lecture technique but a more effective learning mechanism for the student. He can progress logically from the known to the unknown and because his resultant answer 'makes sense', he is more apt to remember and understand the material and not be forced to memorize as is often the case.

Example: The Introductory Lesson "The Nature of Resource"

Figure B

The Changing Nature of Resources

Inter-relationships Among Resources
- relate water (rainfall), landforms, agriculture, forestry, mineral wealth, human settlement

The Forests
- the environmental impact
- mercury poisoning of water systems in Ontario - Reed paper company, Dryden, Ontario
- spruce budworm spraying in the Maritimes - the N.B. experience
- reforestation for tomorrow's industry

The Minerals
- boom and bust - Elliot Lake, Ontario (uranium)
- an uncertain future - Cape Breton Island, N.S. (coal and steel)
- Isolation pay? - Thompson, Manitoba (nickel)
- acid rain - the Sudbury source

Energy
- Hibernia - Newfoundland's economic prosperity
- Tidal power - can it and will it be done?
- Alberta oil - password to power
- a country divided?
- Nuclear energy - a question of waste

Agriculture
- the controversial use of chemical fertilizers, insecticides and fungicides
- the disappearing Niagara Fruit Belt - can Canada afford to lose it?
- Peace River district - the new frontier

Fisheries
- the Canadian American fish war
- the problem of supply - implications of forestry and mining industries, offshore drilling, overcatching
- the seal hunt - good or bad

Aims:

a) to develop an interest in and establish the relevance of the topic of resources to the student;
b) to develop with the students an appropriate definition of the term 'resource' including the connotation of human, capital, and natural types;
c) to establish a sense of the changing nature of resources over time;
d) to discuss, in general terms, the value of resources to Canada.

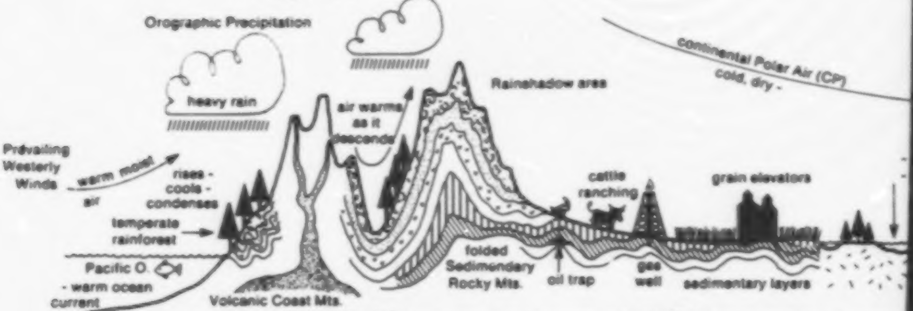
Materials Required:

a) one overhead transparency of an early mineral wealth map (Suggestion: *Atlas of Canada*. Department of the Interior. Toronto Lithographing Company, 1906);
b) one overhead transparency of a circa 1970 mineral wealth map (Suggested source: *The National Atlas of Canada*. Dept. of Energy, Mines and Resources and Information Canada. Toronto: Macmillan of Canada, 1974.

Methodology:

a) Solicit from the students their concept/definition of resource. List responses on blackboard. At this time avoid reference to

Diagram 1



Agriculture —	virtually nil except in isolated valley areas - Okanagan, Fraser delta	rich fertile soils - post glacial Lake Agassiz occupied much of area - flat, lucustrine deposits where rainfall permits - mixed farming, wheat farming (dry farming methods used)	too rocky -eg. Clay
Population —	sparse with exception of coastal area	expanding population in oil developing area	sparse

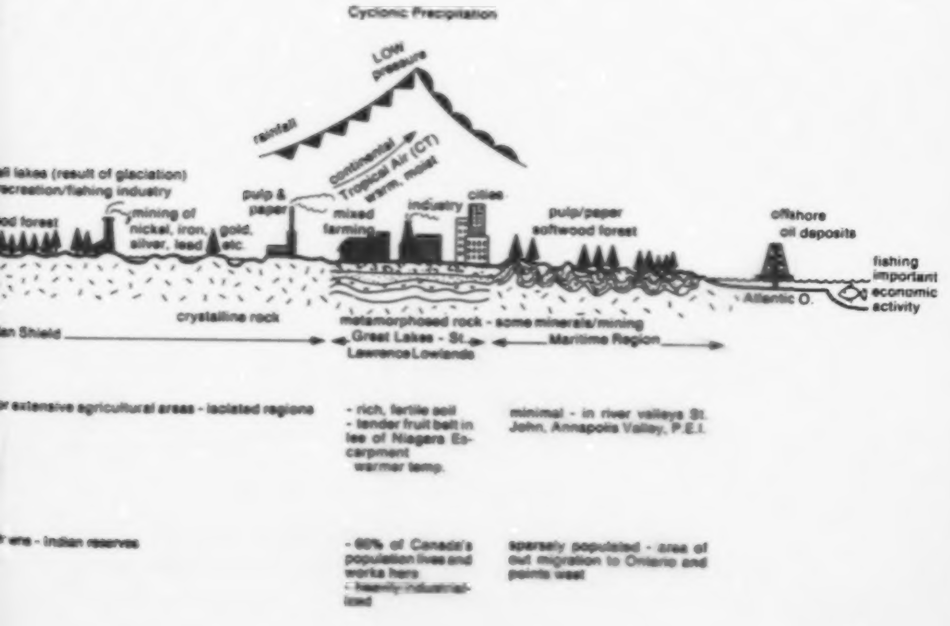
specific examples – e.g. nickel, fish, iron ore. Encourage them to conceptualize in the abstract. Lead them from the concrete, e.g. student responds 'nickel', to the abstract by a series of questions – What's nickel? What's a mineral? What makes mineral ore different from rock?

b) Having defined the term to your satisfaction (see Section 1:1 of notes), now list specific examples with which students are familiar, eliciting responses always from class members. It should be possible to categorize these into the three types of resources – human, capital, and natural – suggested in the notes section.

c) With reference to the list of resources produced by the class, ask "Have all these been considered resources in the past? Why do you think so? Will they continue to be resources in the future? Why do you think so?"

d) With reference to this discussion, show the 1906 map of Canada's mineral wealth. (A copy of same is attached). At the same time show a map of present day mineral exploitation – ferrous, non ferrous, oil and gas, *or* have students refer to the appropriate maps, in their atlases. What differences exist between the two maps? What related changes in society have occurred in the seventy year time span between the two maps (see section 1:3 of notes)? Why does the concept of 'resource' change over time. List responses.

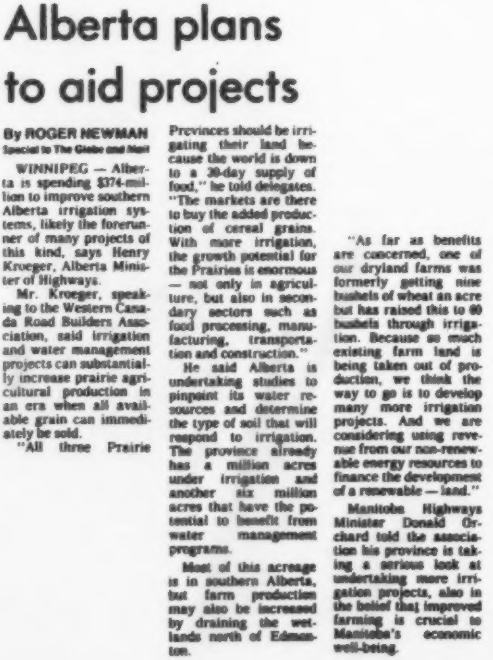
e) Why is the discovery and development of natural resources in particular, of significance to Canada? Reference to maps can assist


Cyclonic Precipitation
LOW pressure
rainfall
continental Tropical Air (CT) warm, moist
ll lakes (result of glaciation)
ecreation/fishing industry
od forest
mining of nickel, iron, gold, silver, lead etc.
pulp & paper
mixed farming
industry
cities
pulp/paper softwood forest
offshore oil deposits
fishing important economic activity
Atlantic O.
crystalline rock
metamorphosed rock - some minerals/mining
an Shield
Great Lakes - St. Lawrence Lowlands
Maritime Region
r extensive agricultural areas - isolated regions
- rich, fertile soil
- tender fruit belt in lee of Niagara Escarpment
warmer temp.
minimal - in river valleys St. John, Annapolis Valley, P.E.I.
r era - Indian reserves
- 60% of Canada's population lives and works here
- heavily industrialized
sparsely populated - area of out migration to Ontario and points west

in bringing out the ideas of opening up the land, pushing back the frontier, developing infrastructure, etc., in addition to export, manufacturing, and job creation factors.

If the teacher is planning to incorporate some aspects of the issue oriented approach in the story of Canada's natural resources, it might be appropriate to follow the introductory lesson with a newspaper study. Encourage students, in a homework assignment over a period of a week, to check the daily newspapers available at home and at the library for articles dealing with technical innovations, government programs, etc., which could alter, once more, the concept of resource. These same articles, when presented to the class, could provide the basis for a short discussion emphasizing the potential environmental impact of such discoveries and programs. For example, in the newspaper item entitled 'Alberta plans to aid projects' (see Figure C), the following questions might stimulate class discussion:

Figure C



Alberta plans to aid projects

By ROGER NEWMAN
Special to The Globe and Mail

WINNIPEG — Alberta is spending $374-million to improve southern Alberta irrigation systems, likely the forerunner of many projects of this kind, says Henry Kroeger, Alberta Minister of Highways.

Mr. Kroeger, speaking to the Western Canada Road Builders Association, said irrigation and water management projects can substantially increase prairie agricultural production in an era when all available grain can immediately be sold.

"All three Prairie Provinces should be irrigating their land because the world is down to a 30-day supply of food," he told delegates. "The markets are there to buy the added production of cereal grains. With more irrigation, the growth potential for the Prairies is enormous — not only in agriculture, but also in secondary sectors such as food processing, manufacturing, transportation and construction."

He said Alberta is undertaking studies to pinpoint its water resources and determine the type of soil that will respond to irrigation. The province already has a million acres under irrigation and another six million acres that have the potential to benefit from water management programs.

Most of this acreage is in southern Alberta, but farm production may also be increased by draining the wetlands north of Edmonton.

"As far as benefits are concerned, one of our dryland farms was formerly getting nine bushels of wheat an acre but has raised this to 60 bushels through irrigation. Because so much existing farm land is being taken out of production, we think the way to go is to develop many more irrigation projects. And we are considering using revenue from our non-renewable energy resources to finance the development of a renewable — land."

Manitoba Highways Minister Donald Orchard told the association his province is taking a serious look at undertaking more irrigation projects, also in the belief that improved farming is crucial to Manitoba's economic well-being.

Toronto *Globe & Mail*
Feb. 25, 1981
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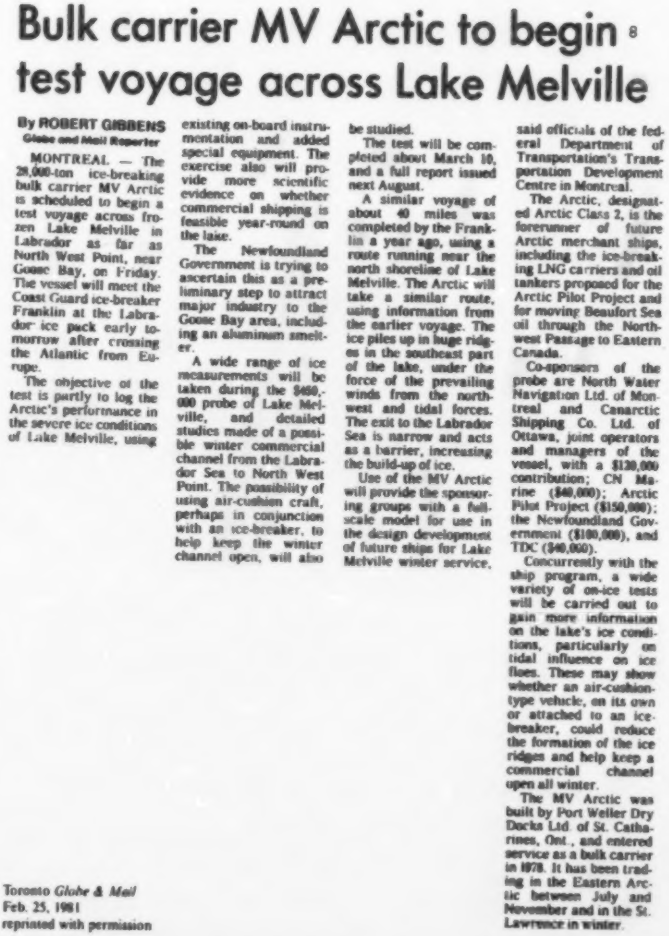
1. Consider the amount of water withdrawn for agricultural use on the prairies (see table 3:1 of notes) in 1974. Since little of the water

used for irrigation is returned to the water system, what effect will an increase in irrigated land have on the prairie water supply?
2. Why is this problem aggravated by the climate of the area?
3. The article suggests draining wetlands north of Edmonton for agricultural production. What environmental repercussions might this have?

In this case, such discussion will enable the students to understand better the many uses of water and the relationships between settlement, water, agriculture, and the natural environment. Similar questions

Figure D



Bulk carrier MV Arctic to begin 8 test voyage across Lake Melville

By ROBERT GIBBENS
Globe and Mail Reporter

MONTREAL — The 28,000-ton ice-breaking bulk carrier MV Arctic is scheduled to begin a test voyage across frozen Lake Melville in Labrador as far as North West Point, near Goose Bay, on Friday. The vessel will meet the Coast Guard ice-breaker Franklin at the Labrador ice pack early tomorrow after crossing the Atlantic from Europe.

The objective of the test is partly to log the Arctic's performance in the severe ice conditions of Lake Melville, using existing on-board instrumentation and added special equipment. The exercise also will provide more scientific evidence on whether commercial shipping is feasible year-round on the lake.

The Newfoundland Government is trying to ascertain this as a preliminary step to attract major industry to the Goose Bay area, including an aluminum smelter.

A wide range of ice measurements will be taken during the $460,000 probe of Lake Melville, and detailed studies made of a possible winter commercial channel from the Labrador Sea to North West Point. The possibility of using air-cushion craft, perhaps in conjunction with an ice-breaker, to help keep the winter channel open, will also be studied.

The test will be completed about March 10, and a full report issued next August.

A similar voyage of about 40 miles was completed by the Franklin a year ago, using a route running near the north shoreline of Lake Melville. The Arctic will take a similar route, using information from the earlier voyage. The ice piles up in huge ridges in the southeast part of the lake, under the force of the prevailing winds from the northwest and tidal forces. The exit to the Labrador Sea is narrow and acts as a barrier, increasing the build-up of ice.

Use of the MV Arctic will provide the sponsoring groups with a full-scale model for use in the design development of future ships for Lake Melville winter service, said officials of the federal Department of Transportation's Transportation Development Centre in Montreal.

The Arctic, designated Arctic Class 2, is the forerunner of future Arctic merchant ships, including the ice-breaking LNG carriers and oil tankers proposed for the Arctic Pilot Project and for moving Beaufort Sea oil through the Northwest Passage to Eastern Canada.

Co-sponsors of the probe are North Water Navigation Ltd. of Montreal and Canarctic Shipping Co. Ltd. of Ottawa, joint operators and managers of the vessel, with a $120,000 contribution; CN Marine ($40,000); Arctic Pilot Project ($150,000); the Newfoundland Government ($100,000), and TDC ($40,000).

Concurrently with the ship program, a wide variety of on-ice tests will be carried out to gain more information on the lake's ice conditions, particularly on tidal influence on ice floes. These may show whether an air-cushion-type vehicle, on its own or attached to an ice-breaker, could reduce the formation of the ice ridges and help keep a commercial channel open all winter.

The MV Arctic was built by Port Weller Dry Docks Ltd. of St. Catharines, Ont., and entered service as a bulk carrier in 1978. It has been trading in the Eastern Arctic between July and November and in the St. Lawrence in winter.

Toronto *Globe & Mail*
Feb. 25, 1981
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stressing the future impact of present actions on natural resources could be developed for the item in Figure D and for any article the the students might present to the class.

The Socratic method attempts to involve the student as an active participant in the learning process rather than a passive recipient of facts. By so doing, the teacher can succeed in creating an enthusiasm and maintaining an interest in the subject matter. Continually recapping briefly on material covered previously and logically linking it to the new lesson also serves to provide cohesion and relevance to the information being presented.

B: Effective Use of Maps, Overlays and Diagrams

Graphic representations are valuable aids for learning and remembering. Maps and map overlays can be used to demonstrate relationships between different environmental factors while diagrams can effectively synthesize an abundance of information. By using these techniques the teacher can provide the student with an immediate visual summary which might otherwise require several pages of written material.

Example: Canada's Resources – A Study in Relationships

Note: Completion of this lession could take up to five class periods depending on the length of period, the availability of materials, and the degree of detail desired in the resulting diagram. If a class set of atlases is the only available source of maps for all of your students, homework assignments may be impossible where atlas work is required. Actual class time would have to be used.

Aims:

a) to establish the relationship between the natural and human resources of Canada and the geology and climate of the country;
b) to develop the student's map making skills;
c) to develop the student's powers of observation and comparison.

Materials Required:

a) one base map of Canada's landform regions
b) five sheets of onion skin paper per student
c) Atlas of Canada for each student (reference for this lesson will be *Gage World Atlas: A Canadian Perspective*);
d) overhead transparencies of landforms, rainfall, forests, agriculture, minerals, and population as described below;
e) coloured chalk

Methodology:

a) Distribute base map and onion skin paper to the students. Have them colour code and label landform regions on base map to your specifications (ref. p. 22 *Gage World Atlas*).
b) On each of the onion skin sheets, trace an outline of the base map, minus landform divisions, and mark on No. 1 rainfall (ref. p. 10), No. 2 forest areas, No. 3 agricultural areas (ref. p. 23), No. 4 minerals, and No. 5 population (ref. p. 10). On the rainfall map also mark on the lines of continuous and discontinuous permafrost (ref. p. 49).

N.B. Insist on neat map work with proper use of map-making skills. Be sure legends on overlay maps do not coincide with that on the base map of landforms.

c) Develop a large cross-sectional diagram of Canada (see Diagram 1, pp. 70-71) by using the questioning technique and by having the students refer to their maps, overlaying one on another to discover the relationships between them.

The resulting diagram can be as comprehensive as required depending on the amount of time available for expanding upon the information. The teacher could spend two or three class periods developing the diagram and include in it related sketches of coal, oil and gas formation/traps, orographic and cyclonic precipitation, rock types and formation, etc. Certainly more space would be required for each landform region if such a detailed diagram was desired.

By developing a lesson of this type, students can see at a glance the inter-relationships among the various resource groups. Any change in one could have repercussions in another area, for example, a slight decrease in temperature and precipitation over time would change agricultural patterns in Canada.

C: Use of the Topographic Map

Topographic maps provide detailed and accurate information about landforms, surface water, vegetation and cultural features and serve as an excellent vehicle for enabling the student to learn about a new area of the country. However, before productive work with topographic maps can begin, students must have an initial understanding of certain concepts – contour lines, contour interval, scale, legend interpretation, latitude, longitude, military grid reference system. The ability to construct a cross-sectional diagram from a topographic map is also an asset if the student is to better visualize the character of the land area covered by the map.

Example: An Industry on the Canadian Shield

Aims:

a) to develop the student's skills in topographic map interpretation;
b) to develop the student's ability to construct a cross-sectional diagram from a topographic map;
c) to develop the student's powers of deduction and interpolation;
d) to increase the student's knowledge about the forest industry on the Canadian Shield.

Materials Required:

a) class set of topographic maps Dryden 52F/15 Edition 2 Scale 1:50,000

Exercise:

1) Construct a cross sectional diagram along a line drawn from Prongers Point on the shores of Wabigoon Lake (155125) to the tip of Rugby Lake (050290). Describe the topography of the area.
2) Examine the length of Highway 17 and the CPR line shown on the map. What evidence is there to corroborate your description of the topography of the area?
3) Note the latitude and longitude covered by the topographic map. Locate the area on an atlas map of Canada. In what physiographic region is it located? What additional evidence from the topographic map supports this observation.
4) Notice the predominant colour on the map. What is the major land use of the area? Given the location and physiographic region, why is this likely?
5) Notice the "loose surface, dry weather and unclassified streets" outside of Dryden proper. Describe the destination of many of these roads. What other type of road is often associated with these? What might be a possible use for such a road?
6) What appears to be the primary acitivity of Dryden? Is the industry ideally situated? Explain. Can you foresee any difficulties because of its location? Explain.
7) The population of Dryden in 1980 was 6800. If we use the figure of 2.5 persons per household, how many households were there in Dryden in 1980. Basing your answer on the facilities shown on the map, what were the occupations of the working members of these households? What other employment opportunities not evident from the map probably exist? In general, how would you describe the majority of these occupations (mill workers and service)?

8) Notice the settlement along the north shore of Wabigoon Lake. Are all of these buildings serviced by roads? What might be another form of transportation? What evidence is there of this? What hindrances to navigation are present in the lake?

9) What other types of transporation are available to the area? Is Dryden isolated? Calculate the distance in kilometres to Winnipeg, Thunder Bay, Toronto.

Followup to this exercise might include a film or filmstrip on the pulp and paper industry. In the case of the Dryden example, the Reed Paper

Figure E

Sport fishing ban cost is set at $3 million

Closing the mercury-polluted English-Wabigoon river system to all fishing would cost the tourist industry in Northwestern Ontario $2-million to $3-million in direct annual revenue, a federal-provincial committee on mercury pollution has been told.

Indian representatives from Grassy Narrows and Whitedog reserves were not invited, but they attended the closed-door meetings yesterday at the offices of the Ontario Ministry of Natural Resources in Toronto.

A sport fishing ban also would mean 308 lost jobs and would cost the province $3-million to $10-million to buy out lodge owners forced to close their operations, according to figures supplied to the meeting by the Ministry of Industry and Tourism.

The meeting reinforced earlier indications that the Ontario and federal Governments will agree to close the system to sport fishing before spring. Commercial fishing was banned in 1970.

However, neither the provincial nor the federal Government has made an announcement one way or the other. The Indians and both Ontario opposition parties have pressed for a sport fishing ban in an effort to stop people eating mercury-poisoned fish.

Cam Mackie, the federal chairman of the committee, would not make any comment, saying, "Any statement would have to be ministerial." Warren Allmand, federal Minister of Indian Affairs, was on his way to Yellowknife and could not be reached for comment.

However, a spokesman for Mr. Allmand said the minister favors closing the system but is awaiting Ontario's views.

Leo Bernier, Minister of Natural Resources, was recently quoted as saying "Don't be surprised" if the federal Government ordered all fishing banned in the system, possibly by the end of January.

Arthur Herridge, an assistant deputy minister with the Ministry of Natural Resources and a co-chairman of the committee, said the committee cannot make recommendations to governments. Rather, each member only informs his minister about the proceedings.

Mr. Herridge, who revealed the financial consequences of closing, said a "ripple effect" would add a revenue loss roughly estimated at $40-million.

Mr. Herridge confirmed that ministry officials have recently been interviewing lodge owners to get opinions on what the Government should do if the system closes.

Toronto *Globe & Mail*
January 21, 1977
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Indians suing Reed for damage caused by mercury poison

Chiefs of the Whitedog and Grassy Narrows Indian reserves launched a lawsuit yesterday for damages caused to their bands by mercury pollution.

Defendants in the suit are Reed Ltd. and related companies, operators of the pulp and chemical complex at Dryden.

A writ issued yesterday in the offices of the Supreme Court of Ontario in Toronto names more than 1,000 members of the two Indian bands as plaintiffs. Each band, represented by its chief and band council members, is also suing as a class.

Ian Scott of Toronto, counsel to the Berger inquiry into a Northern pipeline, has been hired by the bands to handle the litigation.

Isaac Mandamin, Whitedog chief, said after the writ was filed that the Indians are not after money "as much as jobs and economic development. My people have lost their livelihood, which means more than just money."

Simon Fobister, Grassy Narrows chief, said the two bands have not abandoned their campaign for closing the English-Wabigoon river system to sports fishing. "Just because we are moving into the court system doesn't mean we have given up on persuading the Government to close the river to all fishing."

The writ claims damages for several types of alleged wrongdoing, including negligence, trespassing, breach of statute and nuisance.

John Peter Kelly, president of Grand Council Treaty No. 3, representing 23 bands including Grassy Narrows and Whitedog, said that an application has been made in the federal Government to assist with financing of the litigation, but there has been no reply yet.

The operation at Dryden, run by the defendants, often has been named as the source of large quantities of mercury that entered the now-contaminated English-Wabigoon river system.

Toronto *Globe & Mail*
January 21, 1977
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Company was charged with ten counts of pollution of the English-Wabigoon river system in 1977. Repercussions of such environmental abuse could be discussed with reference to newspaper articles of the time (See Figure E). Reference to other environmental issues affecting the forest industry in other parts of the country could be introduced at this time. Again, newspaper articles such as those in Figure F might be useful stimulus to such a discussion. Questions similar to the following might be developed.

a) What is the purpose of tree plantations like those grown by the J. D. Irving Company? How many acres of plantations have presently been established? What is the production of the two Irving plantations annually? What type of trees do they grow?
b) How long has the Irving Company been involved in reforestation on its private lands? What is the advantage of reforesting with plantation seedlings rather than letting nature take its course? Why is this important?
c) The Irving Company uses controversial herbicides in their plantation operation. Why are they used? What is their advantage over manual labour?
d) According to the Irving official, what other industry uses chemical sprays with comparatively little 'bad press'? Does this necessarily make it acceptable? Explain.
e) The forestry industry is becoming more mechanized. Where might the displaced workers find other employment?

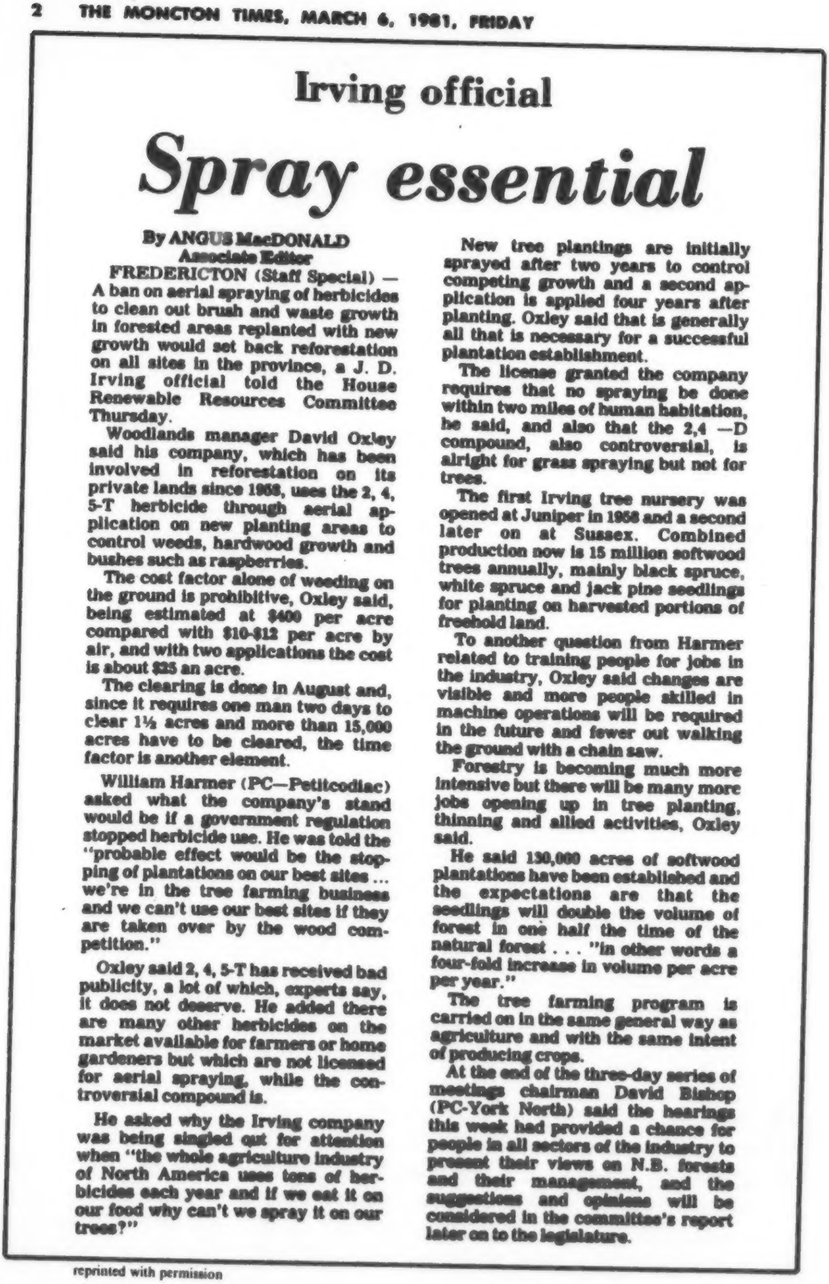
Again, followup on any discussion on the New Brunswick forest industry should include a project, either class or individual student, on the pros and cons of spruce bud worm spray programs. For a more advanced class a debate on the topic might be appropriate.

D: Use of the Case Study

Emphasizing the inter-relationship of natural resources to human and capital resources in a real world situation can often best be accomplished by examination of a particular area in considerable detail. This entails the use of the case study. The lesson developed here relies heavily on references to *Sydney, Nova Scotia: An Urban Study* prepared by E. Roy Harvey and printed in 1971. The information in the booklet, although accurate at the time, is now dated. Reprints of newspaper articles from the *Halifax Chronicle-Herald*, updating the publication, have been included in these notes and will be incorporated into the exercise that follows.

Example: The Cape Breton Industrial Area - the problems of over-specialization.

Figure F



2 THE MONCTON TIMES, MARCH 6, 1981, FRIDAY

Irving official

Spray essential

By ANGUS MacDONALD
Associate Editor

FREDERICTON (Staff Special) — A ban on aerial spraying of herbicides to clean out brush and waste growth in forested areas replanted with new growth would set back reforestation on all sites in the province, a J. D. Irving official told the House Renewable Resources Committee Thursday.

Woodlands manager David Oxley said his company, which has been involved in reforestation on its private lands since 1958, uses the 2, 4, 5-T herbicide through aerial application on new planting areas to control weeds, hardwood growth and bushes such as raspberries.

The cost factor alone of weeding on the ground is prohibitive, Oxley said, being estimated at $400 per acre compared with $10-$12 per acre by air, and with two applications the cost is about $25 an acre.

The clearing is done in August and, since it requires one man two days to clear 1½ acres and more than 15,000 acres have to be cleared, the time factor is another element.

William Harmer (PC—Petitcodiac) asked what the company's stand would be if a government regulation stopped herbicide use. He was told the "probable effect would be the stopping of plantations on our best sites ... we're in the tree farming business and we can't use our best sites if they are taken over by the wood competition."

Oxley said 2, 4, 5-T has received bad publicity, a lot of which, experts say, it does not deserve. He added there are many other herbicides on the market available for farmers or home gardeners but which are not licensed for aerial spraying, while the controversial compound is.

He asked why the Irving company was being singled out for attention when "the whole agriculture industry of North America uses tons of herbicides each year and if we eat it on our food why can't we spray it on our trees?"

New tree plantings are initially sprayed after two years to control competing growth and a second application is applied four years after planting. Oxley said that is generally all that is necessary for a successful plantation establishment.

The license granted the company requires that no spraying be done within two miles of human habitation, he said, and also that the 2,4 —D compound, also controversial, is alright for grass spraying but not for trees.

The first Irving tree nursery was opened at Juniper in 1958 and a second later on at Sussex. Combined production now is 15 million softwood trees annually, mainly black spruce, white spruce and jack pine seedlings for planting on harvested portions of freehold land.

To another question from Harmer related to training people for jobs in the industry, Oxley said changes are visible and more people skilled in machine operations will be required in the future and fewer out walking the ground with a chain saw.

Forestry is becoming much more intensive but there will be many more jobs opening up in tree planting, thinning and allied activities, Oxley said.

He said 130,000 acres of softwood plantations have been established and the expectations are that the seedlings will double the volume of forest in one half the time of the natural forest . . . "in other words a four-fold increase in volume per acre per year."

The tree farming program is carried on in the same general way as agriculture and with the same intent of producing crops.

At the end of the three-day series of meetings chairman David Bishop (PC-York North) said the hearings this week had provided a chance for people in all sectors of the industry to present their views on N.B. forests and their management, and the suggestions and opinions will be considered in the committee's report later on to the legislature.

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Aims:

a) to enable the student to appreciate the effects of technological change on resource development and location;
b) to develop the student's skills in accurate sketch map production.

Materials Required:

a) Harvey, E. Roy. *Sydney, Nova Scotia: An Urban Study*. Toronto: Clarke, Irwin & Co. 1971;
b) selected articles from the *Halifax Chronicle-Herald* from March, 1970 to October, 1980.

Methodology:

a) Instruct the students to draw a large sketch map of Ontario, Quebec and the Maritimes and on it locate the Cape Breton Industrial Area, marking on the towns of Sydney, Glace Bay, North Sydney, and Sydney Mines. By means of arrows, indicate the distances by sea to major Canadian industrial markets – Toronto, Montreal, Halifax. Referring to the atlas, locate and label appropriately the original sources of raw materials for the steel industry (local coal, iron ore from Wabana, Nfld.). Mark Sydney Harbour and the location of the steel mill.
b) In the early 1900's proximity to natural resources was vital for a steel mill. At that time 2.5 tons of coal, 2.0 tons of iron ore, and .8 tons of scrap produced 1 ton of steel. In view of this information, why was the location of the Sydney steel mill ideal?
c) A number of technological changes have occurred since that time. Now .6 tons of coal and 1.1 tons of iron ore and .6 tons of scrap produce a ton of steel. In addition, higher grade ore and cheap transportation costs have made the location of mines relatively unimportant. The costs of shipping finished steel and scrap, however, remains expensive. In view of this information, why is the location of the Sydney steel company undesirable today?
d) On your sketch map draw a circle with a 200 mile radius around Hamilton, Ontario and around Sydney, Nova Scotia. In the same way, draw a circle with a 500 mile radius around the two 'steel towns'. Consult a population map of Canada. Compare the two cities in terms of potential markets included within a 200 and 500 mile radius of their steel mills.
e) Due to technological innovations, the amount of Cape Breton coal used in the coke ovens at the steel plant had more than doubled by 1969. When the marketability of Sydney steel becomes a problem, the steel company is not the only employer to suffer.
Explain the repercussions on the Cape Breton Industrial Area of a declining steel market at Sysco.

f) With reference to the *Halifax Chronicle-Herald* articles dating from March 5, 1970 to October 9, 1980, answer the following:

   i) What has been the trend in Sysco's profit-making ability over the ten year period? One of Sysco's major products is steel rails. Why might the marketability of these vary over time?
   ii) What appears to be the major reason given for Sysco's financial state? In addition to this, what is another cause not mentioned in the articles? Why isn't it?
   iii) What is suggested as the solution to the economic ills of the Cape Breton Industrial Area?
   iv) What was predicted to take place on August 16, 1980? What would be the repercussions in the area?
   v) What opportunities are available for former Sysco workers? Describe the package. How does it compare with Sysco? Is Faro a typical resource town? Explain.

Figure G

The Sydney Steel Corporation (Sysco) showed a profit of $3,292,296 for the 15 month period ending March 31, 1969. . . . . Premier Smith, who made the decision to take over the Sydney steel complex late in 1967, said the profit was an "excellent" one . . . .

Halifax *Chronicle-Herald*
March 5, 1970
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Sale of Sysco best option - - Buchanan

The best thing that could happen to the Sydney Steel plant would be its sale to a responsible, viable and privately-owned steel company, Premier John Buchanan said Thursday.

However, the province would insist on two firm conditions of sale which would have to be guaranteed by any firm which purchased the steel plant, Premier Buchanan said.

"First a purchaser would have to guarantee that the current workforce at Sysco would be maintained. And, secondly they would have to take over the debt of the plant," he said, adding that the debt is currently about $250 million and increasing at a rate of nearly $1.5 million every week.

The premier denied that he or members of his government were negotiating the sale of the steel plant to a West German steel company, or to any other firm.

Mr. Buchanan said a company willing to purchase the plant, modernize it and maintain the workforce could take "a tremendous load off the backs of taxpayers in Nova Scotia" by eliminating the ever growing debt.

He said there are no negotiations currently under way which could lead to the sale of Sysco, as had been suggested by Liberal MLA Vince MacLean (Cape Breton-South) earlier this week.

Mr. MacLean said there were strong indications the West German Korf steel interests were interested in buying the plant.

-Premier Buchanan said he could not understand Mr. MacLean's opposition to a sale to a private company, because, he said it would benefit all Nova Scotians.

The premier said government ownership, simply for the sake of government ownership is a socialist philosophy, and therefore "Vince MacLean must be a socialist" if he can't see the possible benefits of selling Sysco.

Another government member also advocated the sale of Sysco Thursday. Pat Hunt, (PC-Hants-East) said the government should seek a buyer for the plant, and said he suspected it was already pursuing a sale.

Halifax *Chronicle-Herald*
November 23, 1979
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As a summary to a lesson on Cape Breton and its economic ills, entertain the class with some excerpts from the record album "The Rise and Follies of Cape Breton". Several of the selections included in the album capture the spirit and express, rather humourously, the situation on Cape Breton Island.

Figure H

Sysco could be shut down if modernization delayed

SYDNEY – The national director of the United Steel Workers of America told a news conference here Wednesday the Sydney Steel Corp. (Sysco) could be shut down if immediate action is not taken to modernize the plant's basic steel-making facility.

Gerard Docquier of Toronto said government should not wait any longer as Sysco is faced "with a collapse of the furnaces and the coke ovens.

"And without those departments, the plant can't operate," he said. "It is time that the government acted on it."

Sharing the platform with Mr. Docquier were Paul LePage, regional director of the steel workers union, and Ed Murphy, New Democratic Party candidate in Cape Breton - The Sydneys.

The national union leader said a closure of the plant will mean social costs of $100 million a year.

Therefore, it is worth investing "some millions to maintain the mill and the people to keep the community alive and well "

He said a study by national union of officials showed that $150 million is required to make the plant a vibrant operation.

However, he said, the money does not have to be given in one payment.

Mr. Docquier said the modernization should proceed to stages and the required dollars allotted accordingly.

He said the first and most important step is to build a modern steel-making facility.

A good portion of the $7.5 million given to the provincially-owned plant by the federal government should go to the open hearth.

He said the main preoccupation should be with the furnaces, "and then they can rebuild the blast furnaces, introduce either the BOF or QBOP methods, and add casters, rod and finishing mills".

He stressed that one of the prime objectives must be maintaining of the workforce.

The workforce is an important ingredient, and the Sydney plant has the best steelworkers in North America, the union official said. "They can do everything but they can't work marvels in that old plant."

Mr. LePage said a viable, fully-integrated steel industry is the only answer to the economic ills of the area.

He said the union is asking "for something that the people of this area are entitled to."

Mr. Murphy said the union proposals are "sensible and practical as the plan comes to grips with the main issue, the basic steel-making facility which needs to be acted upon immediately."

Halifax *Chronicle-Herald*
January 31, 1980
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In this guide only a small number of teaching aids have been included in the lessons developed. Two others which can be used most effectively are aerial photographs and slides. A most interesting lesson on the Disappearing Niagara Fruit Belt could be prepared by comparing two sets of air photos – one from a text printed some years ago – Tomkins, George S. and Hills, Theo L. *Canada: A Regional Geography*. Toronto: W. J. Gage Ltd., 1962 – and an air photo taken recently. Students could note changes over the time period and evaluate this change given the area of suitable land in Canada for the growth of tender fruits. Aerial photos used in conjunction with topographic maps of the same area can often reveal valuable insights into a particular region.

Similarly a single slide, perhaps taken personally, or reproduced from a magazine (e.g. National Geographic) or borrowed from a filmstrip in your department's collection, can often serve as the basis for a lesson. Let us say that the slide pictured an aerial view of a nickel mining and smelting operation showing slag heaps, rail lines, open pit or mine head, etc. Project the slide directly onto the blackboard and by tracing rough outlines of the relevant items pictured, a lesson on the site and situation of a nickel mine/smelter could be developed. The impact of such a mining/smelting operation on the landscape could be

Figure I

SYSCO CUTS STUN CAPE BRETON

Union, municipal officials demand action, answers

SYDNEY – Steel union and municipal officials are demanding action and answers from the federal and provincial governments in the wake of the announcement by Sydney Steel Corp. (Sysco) president R.B. Cameron Friday that 850 steelworkers will be laid off, beginning Aug. 16.

"Both levels of government have to get together and come up with anwers mighty fast," says Winston Ruck, international representative of the United Steelworkers of America.

Calling the announcement "disappointing and depressing." Mr. Ruck said the major concern is "the effect the loss of 850 jobs will have not only on the steelworkers and their families, but also on the economy of the entire industrial area.

"Even though we sort of expected something like this to eventually happen, it still hits like a bombshell," the union official added.

Mayor Manning MacDonald, expressing 'extreme disappointment," said "somebody in government now must come clean and tell us the future plans for Sysco – regardless of the political consequences."

The mayor said the crisis is "too important an issue to be playing political football with."

He criticized the governments for "not caring about the plight of Cape Bretoners."

Mr. MacDonald feels Cape Bretoners should start "to look after ourselves, and if we have to get tough, then that's the way it's going to be."

Dr. Cameron, in his announcement, blamed the layoffs on soft market conditions accompanied by reduced prices.

These have had a significant effect on the company's ability to market billets and other semi-finished steel products.

The decision does not cancel plans for a complete modernization now being drafted by company and DREE officials, and the corporation will proceed immediately with the rebuilding of its two open-hearth furnaces as well as several other capital projects.

But Sydney Deputy Mayor George MacNeil termed the layoff "a desperate and awful situation."

He said the layoff will mean another 300 to 400 jobs in the business community.

Steel union president Paul Grezel says he is "upset and disgusted."

But he said what "bothers me is the fact that it came so soon after our cancelled meeting with Premier Buchanan, that it appears that he didn't want to be the one to announce the layoff."

Mr. Grezel will cut short his vacation to "see if we can head this off in some fashion."

The union leader says the rebuilding of two open-hearth furnaces will help and he feels that the corporation "hasn't closed the doors completely."

Vice-president John Callaghan said the company action is "discouraging, when we were sort of expecting the governments to come through with money for modernization. It now looks like we will not receive any funds."

Paul MacEwen, MLA for Cape Breton Nova said the news is "a staggering blow to Sydney, and the responsibility must be shared by the federal and provincial governments."

He said the reduction of one-third of the plant's workforce "hardly reflects any truth in Premier Buchanan's election promise of 1978 when he said a Progressive Conservative government will 'go it alone' and make Sysco a success."

Mr. MacEwen also scored the federal government for not releasing the $50 million it committed for modernization purposes.

He accused the government of using what he calls "the old market philosophy of former owner Hawker Siddeley."

"When Hawker Siddeley would lay off workers it used the excuse that markets were soft," he said.

The veteran MLA said that Sysco is like the Cape Breton Development Corporation (Devco) – a Crown corporation "which is set up for social purposes ... to maintain the stability of employment in an area."

Devco, he pointed out, is losing money but it keeps employment stable.

This should apply to the provincial Crown corporation, he added.

Cape Breton County Deputy Warden Joe MacKinnon said the time has come when "the governments must put all the cards on the table."

"The governments should at least tell what the facts are and that should be done immediately."

He pointed out that many more jobs will be lost because of the layoff.

"It is a shocking move that will have a powerful impact on the city and the rest of the industrial area," he said.

Halifax *Chronicle-Herald*
July 26, 1980
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pointed out quite effectively with reference to slag heaps, prevailing winds, town location etc.

Perhaps the best teaching aid available is the field trip. This gives the student a first hand look at a particular resource. Any other technique is, at best, a representation. However because of financial and locational limitations that is all that may be available to the teacher and his students. When this is the case it is up to the teacher to provide the students with the best possible secondary sources of information through the use of air photos, slides, topographic maps and case studies and newspaper articles. It is hoped that this guide has assisted the instructor to do that successfully.

Figure J

New life offered to former Sysco workers

Cyprus Anvil Mining Corp. of Vancouver has cooked up a good deal for Cape Breton tradesmen hit by recent layoffs at Sydney Steel.

Starting salaries of $30,000 per year, subsidized housing and moving expenses are just part of the package.

The catch? The jobs are in the Yukon.

But the prospect of a journey to the land of the midnight sun hasn't kept prospective employees from lining up for interviews.

Company recruitment supervisor Mike Rawlings, in Sydney this week conducting job interviews with former Sysco workers, said Wednesday he has already talked to more than 200 people in two days.

Cyprus Anvil Mining Corp., which operates an open-pit, lead-zinc mine at Faro, 350 kilometres north of Whitehorse, is recruiting about 200 workers from the ranks of former Sysco employees. Between 200 and 250 people will be hired in the next 12 months.

The response, from an employer's point of view, has been overwhelming, Mr. Rawlings said in a telephone interview from Sydney, where he will hold interviews until Friday.

But, he added that from a sociological point of view, it is "hard to fathom" the number of workers affected by layoffs at Sydney Steel.

"It is terrible that there are that many affected."

Most applicants are 30 and under, Mr. Rawlings said.

"They want to start a career and start their families but they cannot do it there (Sydney)."

The Yukon mining company is offering workers a "fairly good package," he said.

Labourers will earn $10 an hour to start while tradesmen – mechanics, pipefitters, welders – will start at $14 an hour. Annual incomes will be between $30,000 and $35,000.

Paul Grezel, president of local 1064, United Steelworkers of America, said there was "no comparison at all" between those rates and the salaries paid out at Sydney Steel.

"Young people with the skills who can stand the rigor of the northern winters can make a nice stake for themselves."

The workers will pay only $55 per month for rent and the company is offering $3,000 interest-free loans to purchase furniture.

Forty new housing units were built at Faro last summer and the company hopes to construct an additional 50 next year.

On top of that, moving expenses will be subsidized. The cost for an average family to move from eastern Canada to the Yukon is $4,000 to $5,000, but Cyprus Anvil has asked the federal government to provide part of the relocation assistance to as far as Edmonton. The company will pay the remainder of the costs.

Mr. Rawlings stressed that Faro was not an isolated community.

"There is good road and air access. We're a community of 1,500 people, the average age is 28 and it's a good place for families."

Because the company experiences a higher turnover with single workers, in choosing new employees it is looking for married persons, with or without children.

Children in Faro can benefit from "a good learning environment," Mr. Rawlings said.

"We have schools starting at the pre-kindergarten level right through to grade 12. The British Columbia school curriculum is taught and the learning environment is good since there are only about 20 students per class so they receive much more individualized attention."

All the usual urban amenities – banks, doctors, dentists, recreation centre and movie theatres – exist in the town, he added. "But everything is on a smaller scale."

However, one part of urban life has not been imported into the tiny mining community. "There is no violence and we never have to lock our doors. I can let my five-year old daughter bicycle from one end of town to the other, knowing I don't have to worry about her."

Halifax *Chronicle-Herald*
July 26, 1980
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Sources of Teaching Aids for Classroom Use

Films:

Films on a variety of topics are available from the following distributors. Write for a catalogue. If you decide to order, you must do so at least two to three months in advance to insure your delivery date. It is suggested that teachers order films at the end of one school year for use during the following year. Organization of course material is a necessity if films are to integrate well into the teaching of a particular topic. The only cost is shipping by post.

Association Films
333 Adelaide St. W.
Toronto M5V 9Z9
1-416-362-2501

City Films
376 Wellington St. W.
Toronto M5V 1E3
1-416-869-1633

Shell Canada Limited
Box 400, Terminal A
Toronto M5W 1E1

Modern Films Talking Picture
Service
9575 Cote de Liesse
Dorval, Quebec H9P 1A3
1-514-631-9010

Maps and Aerial Photographs:

Maps and aerial photographs of the Maritimes can be ordered from:

Maritime Resource Management Service (MRMS)
Box 310
Amherst, Nova Scotia B4H 3Z5

MRMS will also laminate topographic map orders at an additional price of $.50 per square foot. This is well worth the cost if the maps are going to receive a great deal of use. Maps are plastic coated in the process and become more durable.

Maps of other regions of Canada can be ordered from:

Canada Map Office
Dept. of Energy, Mines & Resources
615 Booth St.
Ottawa, Ontario K1A OE9

Mining/Industry Information:

Write to large companies or mining operations requesting free information on their particular industry or mining process. A simple address such as INCO, Sudbury, Ontario, is usually sufficient. Public relations departments usually have prepared materials to fill such requests.

Some Useful References

Blair, C.L., and Simpson. R.I. *The Canadian Landscape: Map and Air Photo Interpretation*. Toronto: Copp Clark, 1978.

An excellent selection of topographic maps and aerial photos accompanied by well developed exercises on each.

Harvey, E. Roy. *Sydney, Nova Scotia: An Urban Study*. Toronto: Clarke Irwin, and Company Ltd., 1971.

A case study of Sydney providing a historical sketch and information, photos, maps, tables and charts detailing urban patterns, economic foundations, and the changing nature of the economy in the Cape Breton Industrial Area. This is one in a series produced by Clarke Irwin. Others include Calgary and Toronto.

Judson, Sheldon and Stokes, William Lee. *Introduction to Geology: Physical and Historical*. Englewood Cliffs, New Jersey: Prentice-Hall, 1978.

This book provides a detailed look at the various elements that comprise the earth, and serves as an excellent reference for teaching aspects of physical geography, particularly rock types, minerals and their formation.

Long, M. and Roberson, B.S. *Teaching Geography*. Toronto: Bellhaven House Limited, 1967,

Discusses the teaching of geography and includes twenty developed lessons on a variety of topics, mostly set in England. The lesson approaches could be applied to any setting.

Stone, W.G. and Inch, R. Spencer. *Geographic Fundamentals*. Toronto: McGraw-Hill, 1963.

Although old, it provides a simplified look at some of the items examined in Judson and Stokes. Content is accurate for today's user.

Tomkins, George S. and Hills, Theo L. *Canada: A Regional Geography*. Toronto: W.J. Gage Limited, 1962.

An excellent source of old air photos for comparison studies. It also provides good examples of exercises which could be developed using air photos, topographic maps, diagrams etc.

Annotated Bibliography

In General

Information, according to eminent sources, is of two kinds: that which is stored in a person's head; and that which is available in libraries. A knowledge of how to use a library is essential to researchers and pays handsome dividends. As many of the references noted in this bibliography come from government departments and agencies, this knowledge takes on special importance. Many libraries can handle government documents only by creating special sections for them, so large is the number and variety of publications each year. The information in these publications is frequently the most accurate and up-to-date there is, and cannot easily be ignored.

Maps are indispensable to the effective study of resource distribution and development. The *National Atlas of Canada* (4th Edition) was published in 1974 by the Department of Energy, Mines and Resources and the Macmillan Company. The atlas deals with all Canadian themes (climate, resource distribution, communications, etc.) so precise data are often rapidly out of date. The overall picture of geographical spread of resources remains, however, and individual updated map sheets are published by federal government departments periodically. In this way the dynamics of resource development can be appreciated. By far the best way to keep up with current resource developments is by reading newspapers. All aspects are covered in styles which are easy to read and understand.

Less expensive is the *Oxford Economic Atlas of the United States and Canada* (Oxford University Press, 1975, 2nd Edition). This smaller atlas also includes the standard maps showing surface features (relief, roads and so on) at a price range within the grasp of students. The Lands Directorate of Environment Canada has also published *Canada's special resource lands: A national perspective of selected land uses* (Map Folio No. 4, Ottawa: Supply and Services Canada, 1979), an excellent large format commentary and atlas on several resource-based topics; we will refer to *Map Folio 4* several times during this bibliography. The geography of Canada is treated at length in *Canada: A geographical interpretation* edited by J. Warkentin (Toronto: Methuen, 1968), and this book richly deserves to be updated. Two annual publications from Statistics Canada are the *Canada Year Book* and its much simplified offspring the *Canada Handbook* (Ottawa: Supply and Services Canada, annually) which contain up to date statistics and commentary on all aspects of Canadian life, including resources.

The historical importance of resources in Canada's development is eloquently summarized in *Canada before Confederation: A study in historical geography*, by R. Cole Harris and John Warkentin (Toronto: Oxford University Press, 1974, Historical Geography of North America series). W.T. Easterbook and M.H. Watkins have edited a collection of essays entitled *Approaches to Canadian Economic History* (Toronto: Macmillan of Canada Ltd. 1967, Carleton Library, No. 31). Of particular interest are chapters on the fur trade by H.A. Innis, the trade in square timber by A.R.M. Lower, treatment of the "staples" approach to economic growth by H.A. Innis and M.H. Watkins, and sections on land policy and agriculture, banking and capital formation, and the state and economic life. Calvin L. Blair, *Canada's natural wealth* (Toronto: McGraw-Hill 1964), outlines the history of individual mineral development up to the early 1960s. Finally, Thomas L. Burton, *Natural resource policy in Canada: Issues and perspectives* (Toronto: McClelland and Stewart Ltd., 1972) deals mainly with the way policies have evolved to cope with resource issues in Canada. Once more, an updating would be useful.

Climate and Water Resources

G.A. McKay, "Climatic resources and economic activity in Canada" (in G.R. McBoyle and E. Sommerville (eds.) *Canada's natural environment: Essays in applied geography*, Toronto: Methuen, 1976) deals with several aspects of climate, including losses due to disasters, climate and urbanization, and climate and recreation. In general books about climatic change tend to be sensationalist; however, R.A. Bryson and T.J. Murray, *Climate of hunger: Mankind and the world's changing weather* (Madison: University of Wisconsin Press, 1978) largely avoids this pitfall in its treatment of global climatic trends.

The book edited by McBoyle and Sommerville (*Canada's natural environment: Essays in applied geography*) includes two chapters on water supplies. Surface waters are treated by F.J. Quinn and E.S. Spence and groundwater by M.L. Parsons. A most useful summary of the water resource situation in Canada is also contained in the *Canada Water Yearbook 1976* published by Fisheries and Environment Canada (Ottawa: Supply and Services Canada, 1976). This was the second Water Yearbook (an earlier edition was published in 1975) and there has since been a later issue for 1977-78.

Agriculture and Fishery Resources

Environment Canada issued a revised edition of its *Climate of Canada for agriculture* in 1978 (prepared by L.J. Chapman and D.M. Brown, Canada Land Inventory Report No. 3) and this provides a good summary of the climatic background to farming across Canada. *Map Folio No. 4* includes lengthy and very good segments on Agricultural Resource Lands (pp. 1-65), which includes a section on the Soil Capability Classification for Agriculture, climate and agriculture, numerous maps and diagrams and an extensive list of references.

Statistics on agriculture depend to a large extent on the Census of Agriculture every five years, and census publications make very dry reading. Agriculture Canada publishes an annual *Selected agricultural statistics for Canada* (Ottawa: Supply and Services Canada) which summarizes historical and recent data on farming. Statistics Canada has also compiled the 1976 census into map form in *Agriculture: Graphic Presentation* (Ottawa: Supply and Services Canada, 1978) which outlines basic patterns across Canada.

The subject of the Canadian land base, particularly for agriculture, has been treated exhaustively. The early efforts of the Canada Land Inventory (C.L.I.) spurred the movement in about 1970 and there are frequent publications from this source or closely related ones. The C.L.I. is presently administered by the Lands Directorate of Environment Canada and useful publications are issued periodically. *Agricultural Land and Urban Centres* (C.L.I. Report No. 11, 1977); deals with the highly sensitive topic of the spread of urbanization into prime food-lands as does *Rural to Urban Land Conversion*, an Occasional Paper (No. 16) of the Lands Directorate. This agency has a quarterly newsletter entitled *Land* which is a useful medium to stay abreast of a variety of publications about land and related issues in Canada (available from Lands Directorate, Environment Canada, Ottawa, Ontario K1A OE7). A series of publications called *Land Use in Canada Series* from the Lands Directorate has included studies on the B.C. Agricultural Land Reserves, non-resident land ownership in Prince Edward Island and other topics; the publications are well-produced and informative. The Alberta Land Use Forum began deliberations in 1973 and published its *Report and Recommendations* in 1976. It deals with many topics, usually in the Alberta context but the relevance of the findings is universal. Topics include the family farm, urban areas and agricultural land, corporate and foreign ownership of agricultural land, and future land needs for agriculture. Finally, and once again from the Lands Directorate, is a series of publications detailing *Land Use Programmes* in all ten provinces and the territories.

The workings of the agriculture industry are also well-documented in Canada. The Agricultural Institute of Canada publishes a quarterly journal called the *Agrologist* (subscriptions available from A.I.C., 151 Slater St., Suite 907, Ottawa, Ontario K1P 9Z9). Recent issues have covered "Farm Mechanization" (Winter, 1980), "Food and Health" (Spring, 1980) and "Soil, Our Dwindling Resource" (Fall, 1980). Two very useful short monographs by John L. Nowland deal with the *Agricultural productivity of the soils of the Atlantic Provinces and Agricultural productivity of the soils of Ontario and Quebec* (Monographs Nos. 12 and 13, Soil Research Institute, Agriculture Canada, 1975). The Science Council of Canada published *Canadian food and agriculture: Sustainability and self-reliance* (Ottawa, 1979) which briefly sets the role of Canada's food production in international terms. R.M.A. Loyns, *Farm to food prices* (Ottawa, Economic Council of Canada, 1980) is a good up-to-date account of the workings of the various sectors in agriculture.

Data on fisheries are published regularly in the *Annual Statistical Review of Canadian Fisheries* (Ottawa: Supply and Services Canada). The current trends in Canadian fishery policy are outlined in *Policy for Canada's commercial fisheries* (Ottawa: Environment Canada, 1976), which also does a good job of explaining why fishermen often tend to be poor; and it sets the stage for the declaration of the 200-mile limit in 1977. Development of the Atlantic fishery is well-explained in *Salt, sea and sweat: A study of Nova Scotia and the vast Atlantic fishery* (Halifax: Nova Scotia Communications and Information Centre, 1977). L.B. Jenson who did many of the illustrations for *Salt, sea and sweat*, has also issued his own book of illustrations explaining, in a non-technical way, many of the species, vessels and techniques which make up the fishery in *Fishermen of Nova Scotia* (Halifax: Petheric Press, 1980). Ann E. Brimer and Gary J. Anderson, *Salar: The story of the Atlantic Salmon* (St. Andrews, N.B.: International Atlantic Salmon Foundation, 1976), is an excellent book written specifically for high-school students and deals with the broader environmental issues surrounding the survival of the Atlantic salmon. It is profusely illustrated and very readable.

Map Folio No. 4 has a section on energy resources which deserves attention. Otherwise the topic is well treated in the literature, particularly by the Department of Energy, Mines and Resources. *Energy futures for Canadians* (Ottawa: Supply and Services Canada, 1978) was prepared by J.E. Gander and F.W. Belaire and is comprehensive. Recent policies and a wealth of data are published in the *National Energy Program 1980* (Ottawa: Supply and Services Canada, 1980) which must, however, be read with a grain of salt as it reflects policy. Energy, Mines and Resources also issues periodic updates on oil and natural gas reserves, coal reserves, electric power generation, nuclear power and so on. *Oil and natural gas reserves of Canada, 1976* (Ottawa: Supply and Services Canada, 1976) deals with the "probabilities" of discovering reserves in given conditions and how these probabilities change with price changes.

Asit K. Biswas, *Energy and Environment* (Ottawa: Supply and Services Canada, 1974) and Allen Milne, *Oil, ice and climate change: The Beaufort Sea and the search for oil* (Ottawa: Supply and Services Canada, 1978), both deal with some of the environmental consequences of the search for, and use of, energy resources. A useful summary by David B. Brooks of the economics of Beaufort Sea oil production is contained in "Black gold: the Beaufort oil rush, the cost of production", *Northern Perspectives*, 8(6), pp. 2-7, 1980 (available from the Canadian Arctic Resources Committee, 46 Elgin Street, Room 11, Ottawa, Ontario K1P 5K6).

The larger consequences of bringing energy to market are tackled in *Northern frontier: Northern homeland: Report of the MacKenzie*

Valley Pipeline Inquiry (Ottawa: Supply and Services Canada, 1977, two volumes). Better known as the *Berger Report* after its author, this report deals in unusual depth and honesty with the effects of major capital works on Arctic habitat, wildlife, economy and society.

Mineral, Forestry and Wildlife Resources

Energy, Mines and Resources publishes extensive works on minerals in Canada, notably the annual *Mineral Resources Yearbook* (Ottawa: Supply and Services Canada) which deals exhaustively with current trends in exploration, extraction and markets for all metallic, industrial and structural minerals. There is also a series of publications, the *Mineral Resource Bulletins* (Ottawa: Supply and Services Canada) which deals with individual mineral groups and related topics.

Forestry and wildlife resources are both given separate sections in *Map Folio 4* and the many publications of both the Canadian Forestry Service and the Canadian Wildlife Service are worth investigation. A recent publication in Nova Scotia called *The Trees around us: A manual of good forest practice for Nova Scotia* (Halifax: Nova Scotia Department of Lands and Forests, and Ottawa: Department of Regional Economic Expansion, 1980) gives a first-class introduction to the rationale behind forestry management. Although not confined to forestry and wildlife resources, the *Illustrated natural history of Canada* (Toronto: Natural Science of Canada Limited, 1970) is a series of nine volumes covering the major physiographic regions of the country and is particularly relevant to the study of plant and animal resources. Each volume is quite well-produced and lavishly illustrated.

J.S. Rowe, *Forest Regions of Canada* (Bulletin 123, Forestry Branch, Department of Northern Affairs and Natural Resources, Ottawa, 1959, reissued as Publication No. 1300, Canadian Forestry Service, Environment Canada, 1972, Ottawa: Supply and Services Canada) is a standard work. There are also various regional treatments of forestry resources.

Themes in Resource Use

Environmental and conservation aspects of resource development and use have a large literature. J.S. Maini and A. Carlisle (eds.) *Conservation in Canada* (Environment Canada, Canadian Forestry Science, Publication No. 1340, Ottawa: Supply and Services Canada, 1974) treats all major resource groups individually. G.R. McBoyle and E. Sommerville (eds.) *Canada's natural environment: Essays and applied geography* (Toronto: Methuen Publications, 1976) is a collection of essays and includes sections on climate, water and soils. A recent publication by R. Lang and A. Armour, *Environmental Planning Resourcebook* (Montreal: Multiscience Publications, and Ottawa:

Supply and Services Canada, 1980) is a summary of many aspects of resource planning and management.

W.W. Rostow's book *The stages of economic growth: A non-communist manifesto* (Cambridge University Press, 1960) has become a standard and repays investigation. W.C. Wonders (ed.) *Canada's changing North* (Toronto/Montreal: McClelland and Stewart, Carleton Library No. 55, 1971) is a collection of papers which emphasizes the role of resources in frontier development. Once more, however, newspapers are the best way of keeping abreast of actual events in this respect.

Also available are multi-media kits for teaching the economic geography of the various regions, e.g. *British Columbia* (1977) *Atlantic Provinces* issued 1978), etc., published by McIntyre Educational Media Ltd. Rexdale, Ontario M9W 5A2. All maps, graphs and data are metric. Each kit contains:

(a) one colour sound filmstrip giving an introduction to the physical features, resources, economic activities and urban centres of the region;
(b) five theme studies, each accompanied by ten slides, dealing in detail with key topics of the region;
(c) a full-colour overhead transparency set to develop map skills and sequential, basic concepts;
(d) a teacher's manual to accompany the filmstrip, also a brief guide to the use of the transparencies.

These kits are already being used in many schools across Canada. They were designed mainly for senior high but much of the visual material is easily adaptable for junior high levels.

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